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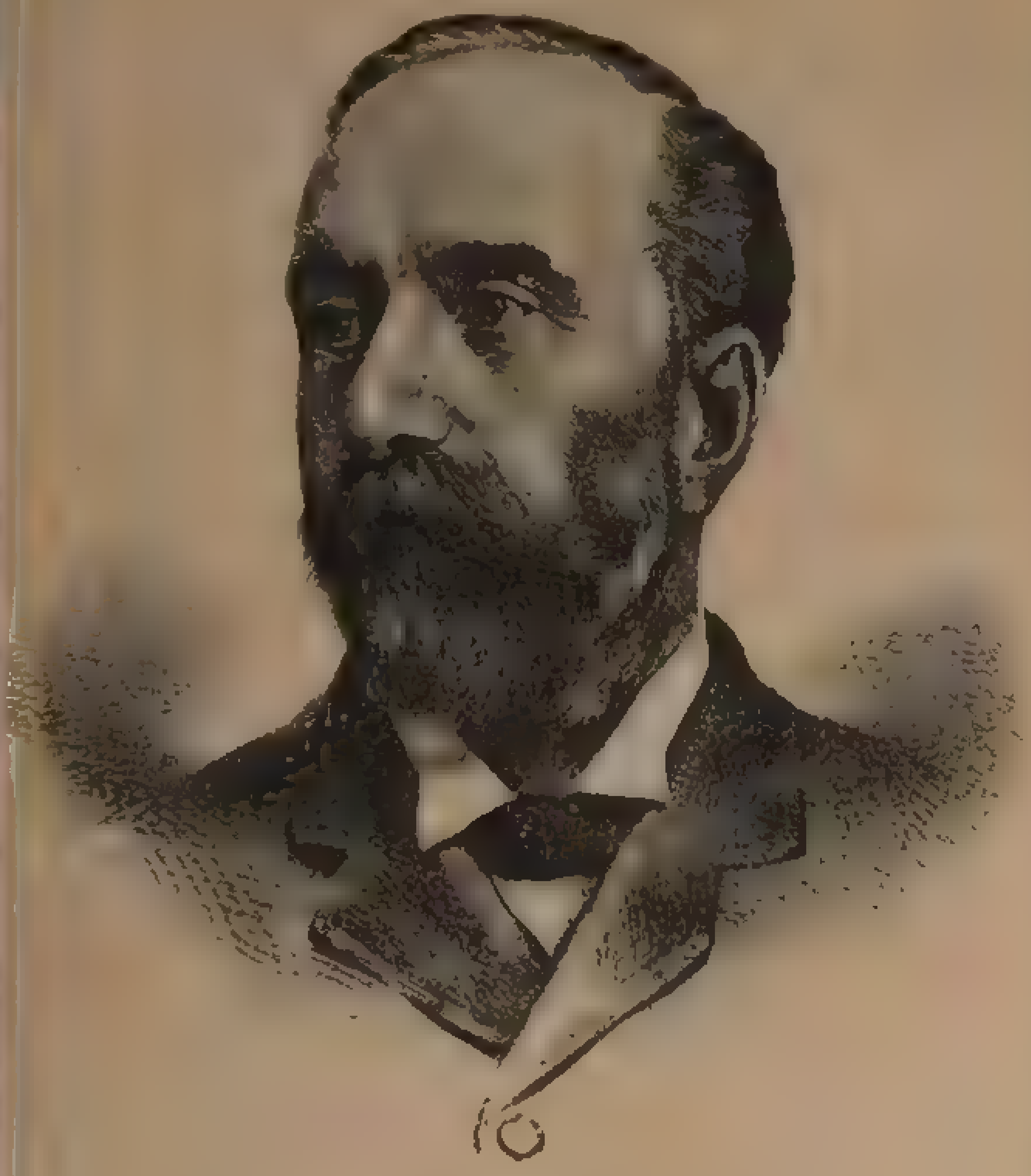

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JOURNAL
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CONGRESS AT LIVERPOOL.

(Continued.)

CONFERENCE OF MEDICAL OFFICERS OF HEALTH.

THE proceedings of the Conference commenced with an address by the President, Mr. C. E. PAGET, Medical Officer of Health for Salford, on "Some Imperfections of Public Health Administration," published in the Journal, Vol. XV., Part III.

On "The Meat of Diseased Animals," by ALFRED HILL, M.D. (FELLOW.)

ABSTRACT.

THE Author said that the question of how far such meat was to be condemned as human food should not be discussed without due regard to the important commercial and economic issues, which were involved equally with those of a purely sanitary character. Certain local diseases, such as foot and mouth disease, hoof rot, and liver rot, should not be taken to disqualify the whole of the carcass. Fluky livers, even when used as food, though probably not very wholesome, were certainly incapable of communicating to the human consumer the parasitic disease with which they were affected. After stating that expert opinion was by no means unanimous in condemning unconditionally the flesh of animals destroyed in the early stages of such diseases as black-quarter, pleuropneumonia, and even rabies, he said that the present recognised rule of procedure might be taken to be, that in the case of most diseases the condition of the meat must be carefully examined, and where this presented all the normal signs of healthy muscle it should be passed as fit for consumption; the only exceptions being made in those cases where special legal enact-

ments had provided for the destruction of the entire carcass. But the main interest of the paper centred in the remarks on the question of how far the flesh of tuberculous animals should be used as human food. He said that, however interesting the experiments of Nocard, Bollinger, and others might be, as showing how tubercle could possibly be communicated by the simple injection or ingestion of the juices and tissues respectively of highly affected animals into others highly susceptible, they could not be taken as illustrating the exact degree of risk incurred by man in eating the flesh of animals only slightly diseased. He quoted largely from the facts of the well-known Glasgow case, and the pronouncements of British and Foreign Departmental Committees and other authorities, and said that the only conclusion we could logically arrive at was that, to say the least of it, the case for total and unconditional condemnation was "not proven." A very animated discussion arose upon the points raised in the last part of the paper, which finally culminated in a resolution being carried on the last day of the Conference by an overwhelming majority. The resolution was as follows:—"That the Conference of Medical Officers of Health adopts the resolution respecting the use of the flesh of tuberculous animals as human food passed by the Society of Medical Officers of Health at their Meeting on March 20th, 1893, viz., 'That, while awaiting the Report of the Royal Commission on Tuberculosis, the presence of tubercle at any stage in more than any one part or organ of a carcass, or the presence of tubercle in any other than the primary stage (crude tubercle) in any single part or organ of a carcass, be held to be sufficient and proper ground for the condemnation of the carcass as unfit for human food, and that all butcher's meat and other flesh of carcasses so affected should be condemned accordingly.'"

Dr. Hodgson (Chairman of the Health Committee of the Crewe Corporation) wished the resolution to go even further than this, and with the consent of the Conference moved a resolution advocating almost universal condemnation.

Dr. Eustace Hill (as a member of the Northern Branch of the Society of Medical Officers of Health, which first passed the resolution now proposed by Dr. Cameron) said that he had pleasure in supporting it; but if it had ever been shown that the eating of cooked tuberculous meat had caused tuberculosis in the human subject, he thought that every one of them present would, without hesitation, go the length of Dr. Hodgson's motion. He thought that the resolution of Dr. Hodgson, if passed, would however have no effect while meat was allowed to be slaughtered in any place but

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a public slaughter-house, for with private slaughter-houses the minute and systematic inspection of butcher's meat cannot be properly carried out. He would point out also that at present there were no means of detecting whether the large quantities of foreign meat were the meat of tuberculous carcasses. He would therefore support the amendment proposed by Dr. Cameron.

Dr. Hodgson's resolution was negatived, and the former, on the motion of Dr. Spottiswoode Cameron, was adopted.

During the discussion of the resolution it was pointed out that, in its amended form, it was in agreement with the general practice on the Continent, as set forth in the following rules of the Belgian abattoirs:—

"The flesh of tuberculous animals to be seized and condemned whenever any of the appended conditions obtain:

I.—(*a*) When tubercle is present in both thorax and abdomen.

(*b*) When tubercle in either thorax or abdomen is associated with its development elsewhere in the carcass.

(*c*) When tubercle is generalized in lungs, pleura, peritoneum, liver, or mesenteric glands.

(*d*) When tubercle of the lungs involves the pleura extensively.

(*e*) When tubercle of any abdominal organ involves the peritoneum extensively.

II.—When tubercle is found in any part in association with marked wasting."

On "Abattoirs," by J. S. Tew, M.D.

(Member.)

ABSTRACT.

In a short paper the author insisted upon the necessity of establishing abattoirs in rural as well as in urban districts, and showed by facts gathered from his own personal experience in a large rural district, that it was quite impossible to guard effectually against the wholesale use of unwholesome meat without the establishment of abattoirs. Rural districts at the present time, he said, afforded too often an open market for meat that could not be sold in towns.

Dr. J. F. J. Sykes (St. Pancras) agreed with Dr. Tew in advocating the general establishment of abattoirs, and pointed out that this country was at least twenty years behind the Continent in the regulation of its meat traffic. He gave an interesting account of the macroscopic and microscopic examination of carcasses and meat in the Berlin and Budapest abattoirs, and expressed an opinion that ere long similar work would have to be done here. It would, however, without doubt, he thought, be entrusted to veterinary surgeons.

On "The Present Position of the Sewage Disposal Problem," by HARVEY LITTLEJOHN, M.D.

ABSTRACT.

THE Author said that it was now generally agreed that conservancy systems had had their day, and that water-carriage was the only method of sewage removal consistent with modern ideas, sanitary or otherwise. He supposed that the slowness with which water-carriage was adopted by the large towns of this country was due to the difficulty of discovering an entirely satisfactory method of ultimate treatment. It would be a matter for congratulation if, as a result of their meeting that day, some further light were thrown upon this difficult question.

On "Slop-Closets and Sewage Disposal," by GEORGE REID, M.D., D.P.H.

(FELLOW.)

ABSTRACT.

IT is not proposed to discuss the relative merits of the various appliances in the market for utilizing the waste water of houses as a flush for closets, the question to be considered is whether it is right in principle and has been found expedient in practice to establish the system in towns. Slop-closets can only be looked upon as substitutes for privies and for out-door use only. Probably all will agree that, as appliances, they are much to be preferred to the old privy; it is, therefore, with the other water-carriage appliances that they must be compared. It may be claimed for slop-closets that they act automatically, are inexpensive, not likely to get out of repair provided they are systematically inspected, and that during periods of frost they do not give rise to any trouble. As a system, they economise the water-supply and diminish the volume of sewage to be disposed of—both important considerations in towns where the water-supply and the sewage have to be pumped. Ordinary water-closets and trough-closets are undoubtedly more cleanly appliances; the initial cost of introducing them is probably not greater than it is in the case of slop-closets; the extra volume of water used is valuable as a flush for drains and sewers; and, with the simple appliances which are now made, and regular and systematic inspection by the

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officers of the Authority they are not likely to give rise to much trouble except during hard winters. Before coming to a conclusion as to whether slop-closets may be accepted as substitutes for ordinary water-closets, their merits and demerits must be well considered, and, what is very important, the local conditions must be taken into account. Recent experiments in Stafford have shown that the answer to the question is not so simple as it would seem, and the arguments in favour of the slop-closet system, based upon the diminution in the volume of sewage to be pumped and disposed of, appear to be far outweighed by the complications which the system gives rise to in the purification process. The highly concentrated sewage, its tendency to undergo rapid putrefaction, and its inertness and want of aëration greatly add to the difficulty already too often experienced in many places in producing an effluent of sufficient purity to be discharged into a stream; also, it would probably be found that in a slop-closet town the question of sewer ventilation would present still greater difficulties than it does at present. On these grounds alone the general introduction of the system appears to be contra-indicated, except, perhaps, in towns where the sewage is largely diluted by manufacturing processes.

[*This discussion applies to the two preceding papers.*]

Dr. Alfred Hill (Birmingham), through whose instrumentality the slop-water flush for closets was first introduced, spoke in favour of the slop-closet. He said that he was quite aware that it was not suitable for all situations and circumstances; few mechanisms, indeed, were so perfect as to be so. He went on to say that it might be urged in favour of slop-closets: (1) that they had an automatic action not readily deranged; (2) that they utilised waste water, and thus effected economy in water supply and sewage disposal; and (3) that they were not liable to injury from frost. He had observed their working on a large scale, and over a long period, and experience had only tended to confirm and strengthen the good opinion he had formed of them long ago.

Dr. A. Bostock Hill (Birmingham) referred to the various methods in use for the treatment and disposal of sewage: viz., (1) by direct discharge into "water-course," "stream," or sea; (2) by precipitation with various agents; (3) by irrigation; (4) by intermittent downward filtration, with or without screening or precipitation; (5) by filtration through chemical media; (6) by electrical treatment; (7) by Hermite treatment and other anti-

septic methods—Amines, &c.; (8) by the Massachusetts filtration method, and others. He said that all these methods yielded poor or bad results at times, and indicated the common causes of failure. Finally he warned public authorities against expecting too much in the way of river purification, especially in the neighbourhood of large towns.

Dr. Barwise (M.O.H. Derby County Council) considered it a hopeful sign that all were now agreed as to certain matters of principle respecting which there was much difference of opinion only a few years back. We all knew, for instance, that processes designed to purify and sterilise sewage have no such effect. He referred with approval to Lowcock's system (in use in Derbyshire), by which sewage sludge could be removed from a settling tank without emptying the latter of its supernatant liquid.

Dr. Boobbyer (Nottingham) drew attention to the fact that the subject of slop-closets was scarcely receiving the attention from speakers in the joint discussion which its importance at the present justly claimed for it. He said that he had recently issued a circular of inquiry to most of the large towns in Great Britain and Ireland, embracing the whole question of sewage collection and disposal, but having special reference to the question whether slop or ordinary w.c.'s were the more suitable for "outside" use. Many towns still contained large numbers of midden-privies and pail-closets, and though anxious to convert them were hesitating how to proceed. Hull had 47,000 privies; Belfast and Bradford, 30,000 each; Manchester, Preston, and Sheffield, over 20,000 each; Aston-Manor, Birmingham, Bolton, Leeds, Norwich, Salford, and South Shields, between 10,000 and 20,000 each. Turning to pail-closets, he said that Manchester contained nearly 79,000; Nottingham over 40,000; Birmingham, 33,000; Oldham, 23,000; Gateshead, Halifax, Huddersfield, Rochdale, Warrington, and Wolverhampton, more than 10,000 each. Four only of the towns, Hull, Darwen, Rochdale, and Warrington, advocated a continuance of conservancy systems; twenty-three advised the use of (wash-down or valve) w.c.'s inside houses, and slop-closets and water-latrines (or trough-closets) outside; and forty-two recommended the use of w.c.'s for both internal and external use—suitable precautions against frost being also very generally specified in the last case. He had recently obtained excellent results with deep latrines and slop-closets in Nottingham (the sewers of which at all times contained a large amount of redundant water), but he had no doubt, from his own experience and that of others whom he had consulted, that, with proper precautions against frost, ordinary w.c.'s were very suitable for outside use in all good neighbourhoods.

On "The Import of Death Returns," by E. W. HOPE, M.D., D.Sc.

(FELLOW.)

AMONG the subjects of public importance there are few which attract less attention and whose meaning is so little understood by the public as the simple weekly statement which enables a comparison to be made in the prevalence of sickness and mortality during one period and another, or between one locality and another.

It may be well therefore to take the opportunity offered by a meeting such as this to refer as briefly as possible to some of the principal features which must be understood before the simple mode of expressing them can be appreciated.

The few observations I have to offer are made with the definite object of facilitating a correct appreciation by the intelligent layman of the facts and figures relating to the health of a city which are recorded week by week in the newspapers.

The first fact to fix in the mind is that quite apart from the sanitary condition of a community, the number who will die during any given period is largely influenced by the ages of the members of that community. In other words, a division of the population into twelve age-groups shows that the number of persons who will die during a year out of every thousand in each of the different age-groups will vary widely.

Tables were exhibited showing the actual number who die each year in England and Wales out of every thousand living at each of twelve given age-periods. The tables showed that if, for example, we could conceive that the whole population of Liverpool consisted of persons between the ages of 25 and 35 the death-rate would be about 7 per 1,000; if, on the other hand, we could conceive that it consisted entirely of people under 1 year of age the death-rate would be about 150 per 1,000, and this with absolutely no change whatever in the general state of municipal sanitation.

Here, then, is the first elementary principle, viz.: that, irrespective of other conditions, the mortality varies enormously at different age-periods. Hence it is self-evident that if the death-rates at each successive age-period be precisely alike in two towns, but in the population of one of them there be a much larger proportion either of very young or of very old persons than in the population of the other, the general death-rate will almost certainly be higher in the former than in the latter, inasmuch as the average mortality of the very young or

very old is much higher than that of persons of intermediate ages.

From this it follows that if we want to make comparisons between mortality returns of different places, we must first ascertain that the populations which we compare are similar in point of age, and if we know that they are not similar, we must adopt some means of correction to remove the error into which we should otherwise fall.

We now come to a second elementary fact. This is the difference occasioned by variability in numbers of each sex, a circumstance which, irrespective of sanitary conditions, affects the crude mortality returns.

The mortality amongst males at different ages differs considerably from, and is generally higher than, the mortality amongst females at the same ages.

Before, therefore, the recorded death-rates in two towns can be fairly put into comparison with each other, or with England and Wales as a whole, as measures of healthiness, they must be corrected for these inherent differences, and the employment of the well-known method of the Registrar-General results in the "corrected" death-rate which differs somewhat from the recorded one.

The next point to which we have to refer is different from the foregoing, and relates to the influence of locality. If we divide the population of this country into those who dwell in towns and those who dwell in the country, we find that the mortality amongst those who live in towns is vastly greater at all ages than amongst those who live in the country, and in no way is this more emphatically shown than by the fact that the crude death-rate in the cities and towns is greatly higher than that in country districts, notwithstanding that the cities and towns have very much more than their share of people in the prime of life; whilst on the other hand, the country districts have more than their share of persons at the high mortality periods of life: *i.e.*, infancy and old age.

The reasons of the destructive influences of the City are to be found in the aggregation of human beings, the destructive nature of the worries and cares of life, the prejudicial influence of confinement, the character of many trades, &c., general insanitary surroundings, filthy habits, drink, and so on.

We want to know before we can compare one town with another—1st. What is its age and sex distribution? and 2nd, How much of it is really urban, and how much of it is purely rural? We have a rough gauge in the density of population per acre. If for example we find that, as in the case of Leeds, the population is stated to be seventeen to the acre, we know

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that a very large proportion of that city must be of purely rural kind. Similarly Croydon with twelve to an acre, Huddersfield with eight to an acre, Dublin with fourteen to an acre, all imply that a large area under rural conditions is incorporated with the township. Hence in the return of such cities there are no means to distinguish between what is urban and what is rural. London is the chief sinner in this respect, and its enormous rural or semi-rural areas contribute to enable it to pose before the world as the healthiest of capitals.

Our own city is an example, and, as far as I know, almost the sole example of a purely urban municipality, without even the statistics of its own suburbs to modify the influences inseparable from labour and toil. The density of the population is 114 to the acre, that is say, twice as great as that of London, seven times that of Leeds, nine times that of Norwich, and fourteen times that of Huddersfield.

This purely urban municipality must not be compared with those towns and cities which partake largely of suburban and rural advantages, but it is extremely difficult to make these facts appreciated by the public, and even prominent municipal rulers are astonished at the contrast, say, between the City of Liverpool and the Borough of Hastings or Eastbourne, and regard the contrast as appalling and disheartening, and seem to feel that the sanitarian has not left one solitary footprint upon the sands of our Stygian shore.

It is accepted as a general fact that the age and the sex distribution in communities varies very slowly indeed, consequently we find the real value of crude death returns is an index of the progress of a city or any other community year by year.

The records year by year furnish means of comparing the same place under varying conditions, and indicate either retrogression, a stationary condition, or progress. Herein is the real value of the returns. Attempts at comparison between places which are altogether dissimilar must lead to fallacious inferences.

One other matter requires a reference, and it is one which is applicable to all communities, rural or urban, and that is the necessity for a more frequent census enumeration.

Ten years is too long a period to elapse before correcting enumerations of population, and it is to be hoped that ere long a quinquennial census will be substituted for the present ten-year one.

No one knows better than the audience addressed that there is no city, starting like Liverpool did, and handicapped as Liverpool has been, which has surpassed Liverpool in its sanitary progress and its sanitary administration.

The vast sums which the rulers of past times and the rulers of present times have expended and still expend on great sanitary operations have been attended with an ample reward, and that reward would have been greater, and will be increased, when the lower orders themselves evince the inclination to co-operate in the work for their own benefit, and endeavour by temperance, cleanliness, industry, and self-restraint, to second the efforts of the municipal governors.

Dr. George Longstaff (Chairman of the Buildings Committee of the London County Council) remarked on the impossibility of satisfactorily comparing towns as a whole with one another, without reference to their age, size, situation, staple trades, populations, and other like points of importance. Similar towns, he said, might be compared, or similar parts of different towns, but a general comparison without regard to these points was valueless and misleading.

On "What should be classed as Dangerous Infectious Diseases?" *by* Joseph Priestley, B.A.Lon., M.D.Edin., D.P.H.Camb.

All infectious diseases are dangerous to the public in regard not only to the deaths they cause, but to the suffering and ill-health they give rise to, and ought to be notified, so that, theoretically at least, they may be prevented by subsequent isolation, disinfection, and the other preventive measures with which we are all well acquainted. I repeat that all these infectious diseases can be stamped out and prevented theoretically; but what we have to consider is the practical bearing of the subject—the best results to be obtained practically under present existing conditions and with the present means at our disposal. Such is the subject I intend to deal with.

The Notification Act of 1889, Section 6, gives as infectious diseases the following: "Small-pox, cholera, diphtheria, membranous croup, erysipelas, the disease known as scarlatina or scarlet fever, and the fevers known by any of the following names: typhus, typhoid, enteric, relapsing, continued, or puerperal; and includes, as respects any particular district, any infectious disease to which the Act has been applied by the local authority of the district in manner provided by this Act." The latter half of this section applies to such infectious diseases as measles, whooping-cough, diarrhœa, phthisis, cancer, Influenza (with a capital I), leprosy, &c., and it must be remembered that it is to some of these at present non-notifiable infectious

diseases that the high zymotic death-rate is chiefly due. The above-mentioned infectious diseases of the Notification Act become in a later Act, *e.g.*, the Public Health (London) Act, 1891, Sections 58–74—*dangerous* infectious diseases, and of these I will treat in the above order as nearly as possible, pointing out at the same time those that I do not think ought to be so included—at least for the present.

Small-pox, &c.—With an unprotected element gradually, but certainly, increasing, small-pox, by virtue of its extremely loathsome character and disfiguring tendencies, is perhaps the most important disease with which we have, or shall have, to deal; and in this connexion I would point out that in semi-protected persons this disease may assume such protean (modified) forms that the differential diagnosis between it and chicken-pox may become extremely difficult, if not at times well-nigh impossible. Such being the case, chicken-pox might with advantage, at least in times of epidemics, be classified as a dangerous infectious disease, and its notification be made consequently compulsory. In the same way and under the same conditions diarrhœa and sore-throat might be so classed in connexion with epidemics of the more serious diseases—cholera or typhoid fever, and diphtheria or membranous croup (this latter disease being an affection of the air passages indistinguishable, in my opinion, from diphtheria in origin). The difficulty in epidemic periods of drawing a line between diphtheritic and non-diphtheritic throats, between choleraic diarrhœa and true cholera, between chicken-pox and modified small-pox, is well known to us all, but personally I look forward with great hopes to these difficulties being dispelled by bacteriological diagnosis. The importance of this advance in the matter of children attending school is apparent. Bacteriological examination will be applicable in the same way to cases of cholera or suspected cholera, and will—in the near future, I hope—be applicable to chicken-pox and modified small-pox, now that we are on the point of capturing, if we have not already captured, the germ of small-pox.

So much for small-pox, cholera, diphtheria, or membranous croup, about the dangerous infectious nature of which there is no doubt, and for which notification, isolation, disinfection, and quarantine, or medical inspection, are all-important, more especially when the first step (notification) is successfully and carefully carried out, and that, too, by the bacteriological methods mentioned above, if required. In this connexion I may mention, as a matter of interest, that in New South Wales there is a Notification Act (restricted to small-pox, however) requiring householders and medical practitioners "forthwith to

report every case which may be reasonably supposed to be small-pox," the responsibility then being removed from the practitioner to the Health Department. Some such wording in our Acts would be useful until such time as diagnosis became more certain or the rising generation of medical men more educated in infectious diseases.

Erysipelas.—As regards this disease, I am bound to confess that I fail to see the use of notification or of including it in the list of those which are dangerously infectious. Does the disease spread from individual to individual? The majority of cases notified in Leicester are trifling in character and have no real bearing upon public health. Further, some of the cases are apt to recur, and so repeated notifications for the same patients are sent in. Erysipelas might, in my opinion, with advantage be expunged from the list of dangerous infectious diseases. In Leicester the notification of this disease has cost £574 for 4592 certificates during the last fifteen years.

Scarlet fever, typhus fever, typhoid or enteric fever, and relapsing fevers (the last three constituting the group of continued fevers) may all be classed with the first group I have named—viz., small-pox, cholera, diphtheria, or membranous croup, as dangerous infectious diseases requiring the stringent preventive measures mentioned above.

Puerperal fever.—Regarding this disease I agree with Drs. Herman and Cullingworth in looking upon it as a wholly preventible disease—a blood poisoning due to the introduction from without of a particulate poison, which gives rise to a severe febrile illness, occurring soon after, and being dependent upon, delivery. The carrying medium may be the hands, instruments, dressings, &c., and the disease is due to want of proper cleanliness and antiseptic precautions. That the disease depends upon a micro-organism is highly probable, but such organism can only be transferred by contact—and this transference can be prevented by cleanliness and the use of antiseptics. Notification is certainly useful, so that inquiries may be made, and preventive measures taken, if necessary, in regard to medical men, nurses, and midwives. The disease, however, ought, in my opinion, not to exist at all.

So much for the so-called "dangerous" infectious diseases, about which there ought to be practically no difference of opinion; and now I will deal with those about which opinions differ considerably at the present day, foremost among which are measles and whooping-cough, diseases which have high mortalities and widespread epidemic prevalence. In both these respects these two diseases ought to be preventible. But how? Notification is suggested, and would doubtless be useful, but

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not in the sense that it is useful in the diseases I have already considered. For instance, in measles notification (more especially early notification) would be useful in warning us of an approaching epidemic; in enabling us to close certain schools (elementary or otherwise) if necessary; in bringing together a close relationship between the health departments and the people, thereby enabling precautionary instructions to be given (and of course carried out) as to the dangers of measles, so as especially to prevent exposure to chills; in enabling us to isolate the other children in a household and to keep them away from school; in carrying out disinfection of houses, bedding, clothes, &c.; and, in fact, in generally drawing the attention of parents to the seriousness and dangers of measles, and so disabusing their minds of the extreme folly of looking upon measles as a disease to be "got over," and doing away with the apathy that unfortunately exists in regard to this particular disease. Insanitary arrangements, again, would be discovered by our inspectors, and it must be remembered that insanitary surroundings *indirectly* increase largely the mortality from this disease. It is true that we must trust to "home" isolation such as it is, for in this disease at present hospital isolation, with its attendant expenses, would be practically impossible, not only on account of numbers and the early ages of the patients, but also on account of the intensely infectious early stage (pre-eruptive) of the disease leading to rapid spreading, and its long incubation period.

By such means as the above the mortality from measles would be diminished, though I doubt whether its incidence, and therefore its epidemic tendency, would be lessened. Such at least is the practical experience of towns that have tried, or are trying, the experiment. Still, such an advantage as lessening the mortality might counterbalance the necessary expenditure and trouble, and, considering the high mortality from measles, anything that can be done ought to be done to lessen it. The same arguments apply practically to whooping-cough—indeed, the high mortality from these two diseases is a distinct blot on preventive medicine. In Leicester during the last twenty years we have registered 1212 deaths from measles and 1160 deaths from whooping-cough; and surely for the next twenty years there ought to be a very great improvement upon this, more especially as these diseases are pre-eminently preventible, at least in respect of their mortalities. If not, preventive medicine is indeed a failure as regards measles and whooping-cough. Without notification, however, health authorities can do nothing, and, though we are not in a position at present to follow up in every case such notification with the

other well-known preventive measures known to us, I think the mere fact of knowing the localities of infected houses would enable us to effect, by means of advice, &c., material good, and to satisfactorily diminish these death-rates. The worst cases—those especially living under the most insanitary conditions and in the most destitute circumstances—might be removed to hospital with great advantage, even though one admits the impracticability of stamping out the disease by isolating each case as it is notified. These two diseases are also the cause of much impaired health arising from their after effects; and if notification leads to more careful nursing and greater precautions against chills, the result will be highly satisfactory, and will tend to improve the public health of the rising generation.

Whilst fully admitting the fact that wide-spread diarrhœa may be an antecedent to epidemics of typhoid fever or cholera, and therefore, if notified, may lead to the knowledge, and perhaps to the prevention, of a coming epidemic storm, I do not think that with us such stringent precautions are necessary—more especially considering the rarity, not only of cholera, but also of serious typhoid fever epidemics. Further, in infantile (or epidemic) diarrhœa, nothing is to be gained from notification—the average duration of the disease being so short and its supposed etiology so involved. This disease, further, can hardly be described as infectious, though it is most probably due to a micro-organism.

In phthisis we have a disease that is undoubtedly infectious and might therefore be notified, so that precautionary measures might be taken as in the case of measles and whooping-cough; to follow up such notification, however, with other strict measures would be not only irksome and intolerable to the patients themselves, but also useless to the community at large. Phthisis is spread chiefly, if not entirely, by contact, and with ordinary precautions this spread is preventible, so that it is sufficient for our purpose to know the localities of infected houses, in order that such ordinary but highly necessary precautions may be taken. Strict isolation in this disease is not necessary, whilst disinfection is in some places even now carried out on death returns.

In cancer, whether the so-called "organism" is a protozoon or a product of cell metamorphosis, the etiology is so obscure that we may, for the present at least, regard the disease as not infectious, and therefore not to be notified.

Epidemic influenza is a highly infectious disease with a high mortality rate (direct or indirect) and an extremely short incubation period. The disease is in every way comparable with

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measles, with the exception that, whereas a bacillus is assumed in the latter, it has been isolated and carefully investigated in the former. Isolation of this disease is all-important, but practically impossible—at least, in hospitals—owing to the mild nature of some of the cases and the extreme infectivity of the early stages. Home isolation and strict precautionary measures —*e.g.*, disinfection of sputum and nasal secretions—must be trusted to, and to enable these to be the better enforced notification might certainly be of advantage.

The last disease I shall touch upon is leprosy, and I shall content myself with saying that New South Wales is grappling with it satisfactorily by means of an Act passed in 1890 "providing for the notification, detention, and isolation of leprosy cases, with the appointment of lazarets." Such are the lines to go on.

In conclusion, although I look upon all infectious diseases as dangerous more or less, it is of advantage to divide them into two classes—viz., (*a*) *dangerous* infectious diseases, and (*b*) *ordinary* infectious diseases; including under the first heading those diseases which require the most stringent means for their prevention—viz., notification, isolation, disinfection, quarantine or medical inspection, and scientific inoculation. Under this heading we have small-pox, cholera, diphtheria or membranous croup, typhus, typhoid (enteric fever), relapsing or continued fevers, leprosy, and perhaps the disease known as scarlatina or scarlet fever; whilst under the second heading we have diseases that are no doubt infectious, but only to such an extent that ordinary precautions may with advantage be taken, or with which the circumstances—*e.g.*, extreme infectiousness of early stages, tendencies to rapid spreading, &c.—are such that under existing conditions it would be practically impossible to have strict preventive measures carried out. In all these cases I am of opinion that notification is required, with the two exceptions, perhaps, of erysipelas and cancer. Under this second heading I include measles, whooping-cough, epidemic influenza, phthisis, and puerperal fever. Diarrhœa, chicken-pox, and sore throat may with advantage be made notifiable under epidemic conditions of cholera and typhoid fever, small-pox, or diphtheria respectively.

Dr. SEATON (M.O.H. Surrey County Council) showed a series of maps, which he had also exhibited as part of his report on diphtheria at Budapest, illustrating the slow but continuous transfer of the incidence of diphtheria from N.W. to S.E. England during the twelve years, 1881–1892.

On "*The Chemical Training of Medical Officers of Health,*" *by* HERBERT E. DAVIES, M.A. (Cantab) B.Sc. (Lond.) F.I.C.

ABSTRACT.

THE help of chemistry is necessary in Public Health work. The holder of a diploma in Public Health is supposed to have been trained in chemistry, therefore too often local authorities consider that their Medical Officer is able to do the work of a public analyst. But neither the training nor the examination are of any use as far as practical chemistry is concerned. In the case of men qualified before 1890 no definite training of any sort is required, those qualified after only take out three months' practical work.

Those best qualified to know, consider that nobody is competent to undertake the duties of public analyst who has not obtained the Fellowship of the Institute of Chemistry. This body demands at least three years' training before examination, and three more years spent in the exercise of his profession before a man is eligible for the Fellowship.

The examination in chemistry for the diploma in Public Health is no test of practical knowledge, being incomplete and unreal. The examination was never meant to qualify men for the post of analyst, and really seems unnecessary, as the time would be better spent if devoted to subjects of more immediate importance to him as a Medical Officer of Health. It is no use for a man to spend time in learning how to make sham and useless analyses of food and water.

At the conclusion of the Conference the resolution already referred to, condemning the use of the flesh of tuberculous animals as human food, was carried with only three dissentient votes, and another resolution, proposed by Dr. Barwise (Medical Officer of Health, Derby County Council), to the effect that Medical Officers of Health and Sanitary Inspectors should no longer be appointed for limited periods, was carried unanimously. The resolutions were referred to the Council of The Sanitary Institute for the consideration of that body.

The Conference was well attended throughout. About 140 Medical Officers of Health from all parts of the three kingdoms attended on the opening day.

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CONFERENCE OF MUNICIPAL AND COUNTY ENGINEERS.

THE proceedings of the Conference commenced with an address by the President, Mr. A. M. FOWLER, M.Inst.C.E., published in Vol. XV., Part III.

On "The Disposal of Town and other Refuse by Burning," by JAMES DEAS.

ABSTRACT.

THE question of dealing with towns refuse has occupied the attention of local and municipal authorities in this country for many years past. Various schemes have been suggested to remedy the evil, but all are now agreed that the most economical and safest from a public health point of view is to destroy it by fire.

The great objection to the forms of destructor now in use is the possibility of offensive vapours and charred paper going up the chimney shaft and causing a nuisance to the surrounding neighbourhood. The charging arrangements are so constructed that the outlets of combustion are at the back of the furnace, and that whilst a charge is burning upon the furnace bars, the next charge is upon the dead hearth near the outlet flue where it undergoes drying and partial decomposition, with the result that offensive vapours are given off without being exposed to sufficient heat to render them inoffensive. (See Report of the London County Council.)

The following are the necessary conditions for a perfect destructor:—

1. To destroy rapidly all unscreened refuse from a town of whatever description without committing any offence or possible nuisance.

2. To reduce the refuse dealt with, to the least possible amount of clinker.

3. To deal with the refuse and bye-products with the greatest economy and efficiency.

In the new destructor at Warrington the above conditions are complied with and successfully carried out. It has now been in operation and worked continuously day and night for thirteen months.

The total height from ground level to charging platform is only 8 ft. 9 in., half the height of the inclined roadway to other destructors. The refuse is tipped direct into a hopper and falls down on to the inclined path, where it is partially burnt and dried, and all the gases are absolutely destroyed by the radiation of the intense heat of the furnace as they are drawn through and over the hottest part of the fire, entering into ignition and complete combustion in the chamber (where a temperature of over 2000 F. is maintained) before finally passing away to the boiler. This intense heat and form of furnace does away with the necessity of a second fire, dignified by the name of cremator.

Mr. Carter Bell, County Analyst, has tested the escaping gases several times, and the following is his analysis:—

The results are given in percentages by volume:

Carbonic Acid	7·2
Oxygen	11·8
Nitrogen, Sulphurous Acid, Water Vapour	81·0
	100·0

He adds in his report:—"I drew various samples of gases from the chamber at the foot of the chimney shaft, and in no case did I find the slightest trace of sulphuretted hydrogen or mephitic vapours. There is NO TRACE of *carbonic oxide.*"

The average quantity burnt per cell by other forms of destructor is given at 6¼ tons per 24 hours.

The following figures are given by an independent 24 hours test on this destructor by the Leeds Corporation.

(COPY CERTIFIED.)

Tests of "*Beaman & Deas*" Destructor Furnace.
Warrington Installation.

Date (noon to noon), November 23rd and 24th, 1893.
Duration of trial, 24 hours.

Nature of Fuel, Unscreened Refuse.

Total quantity of fuel burnt	53536 lbs.	=	23 tons 18 cwt.
Quantity of fuel per hour	2231 lbs.	=	19 cwts. 3 qrs.
Tl. qnty. of water evaporated	61344 lbs.	=	6134 galls.
Qnty. of water pr. hr. (1271 h.p.)	2556 lbs.	=	255 galls.
Weight of clinker produced	14980 lbs.	=	6 tons 13 cwt.

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Per cent. of clinker	27·9
Pressure of steam maintained	68 lbs.
Temperature of air in boiler house	45°
Temperature of feed water	104° F.
Temperature of gases leaving damper	650° F.
Quantity of water evaporated per lb. of house refuse	1·14
Average temperature by copper wire test	2,000° F.
Average air pressure (water) maintained	2½ ins.
Draught velocity in feet per minute	820

(Signed) GEORGE DARLEY,
Supt. Ashpit Cleansing Department, Leeds.

GEORGE T. CARTER,
City Engineer's Office, Leeds.

The whole refuse is weighed at the works and the daily amount burnt in this furnace equals 20 tons per 24 hours, which far exceeds all other forms at present in use. Objection has been raised by parties viewing this destructor at Warrington to the high temperature attained, and the possibility of the brick-work being rapidly burned away. The experience of thirteen months continuous working does not confirm this opinion, as no repairs have been necessary and no expense has been incurred.

During the process of burning, fine particles of dust fix themselves on the crown of the arch and exposed portions of the furnace in a stalactitic form, thus protecting the brickwork from the intense heat.

The following analysis was made by Mr. J. Carter Bell:—

Silica	55·364
Oxides of Iron	15·711
Alumina	17·362
Lime	5·390
Magnesia, Potash, Soda, Sulphuric Acid ...	6·173

This furnace has been at work since August, 1893, and is as good now as on the day it was erected.

I have made repeated experiments in burning sludge mixed with town refuse with success. The following test was made a few weeks ago:—One ton of sludge mixed with one ton of unscreened town refuse, when the whole was completely burned in 1 hour 35 minutes and gave 25 °/₀ clinker.

From daily experience I find that I can evaporate 1 lb. of water from 1 lb. of unscreened town refuse, and the value of steam, in my opinion, by burning towns refuse will form a very important factor for corporations in the near future.

On "The Acme Refuse Destructor," by H. Royle, Assoc.M. Inst.C.E.

It is a matter of universal admission that the heaping together of putrescent or decomposing matter such as towns' refuse, is an evil, and that as yet no better process by which it can be converted into fixed and harmless products has presented itself or been proposed than combustion. As by this means all the organic products present (these being the objectionable portions) are converted into the comparatively, if not absolutely, harmless forms of water vapour, that is pure steam, carbonic acid gas, and nitrogen, all of which are contained in atmospheric air as it is commonly found.

This desirable effect is brought about by means of a furnace-like apparatus known as a "Destructor," a somewhat inappropriate name inasmuch as matter cannot be destroyed but only changed. Of these destructors there are many forms offered, each more or less efficiently doing its work. It would be a tedious waste of time to individually criticise the construction and merits, or demerits of each one. The general construction of all is very similar. The refuse to be burned is dropped on to a sloping bed at the back of the furnace where it loses the water and other volatile matter contained in it. From thence it is moved on to the bars or furnace proper, and there the remaining organic matter is burnt out; finally the ashes or clinkers, that is the non-combustible portion, is raked out. It appears that the real character of this drying bed has been much overlooked, and that it is not generally known what an insanitary sinner it is.

The mode of working generally adopted is as follows:—When the charge on the lower bars is sufficiently burned, the attendant rakes out the greater portion, leaving on the bars a sufficiency of burning material to ignite the next charge which he rakes or pushes down from the drying bed, which drying bed again in its turn is covered with a fresh charge of raw material; when the dried charge comes into contact with the red hot portion left on the bars, a process known to chemists as dry distillation commences, and this continues until the ignition is complete or until the bulk is converted into charcoal. It is well known to chemists that the products resulting from the dry distillation of organic matter containing much nitrogen and sulphur (such as fœcal and other like matters always do) are invariably of a most nauseous and offensive character, noxious to the sense of smell and likely to be pernicious from a sanitary point of view. These vapours in their turn pass over the drying bed, causing the elimination of vapours of the same character

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and similar properties as themselves, and this goes on charge after charge, and were it not for a high chimney, which like charity covers a multitude of sins, the presence of such a so-called destructor would be unendurable in any neighbourhood. That this state of things exists, a sudden visit, incognito, to one of these destructors will prove to any persons desirous of knowing the truth of the matter. Even inspection of the chimney top and its tinted vapours will to some extent show the various stages of the process. It seems that a destructor is deemed to be doing perfect work if it does *not* produce a local smell and *does* produce a quantity of hard slaggy cinder, which can be shown with great pride to visitors as an undoubted proof of its great efficiency.

That this state of things has not passed unobserved is shown from attempts made to obviate the evil. To this end rocking bars have been employed; these by their motion bring the raw or dried charge on to the glowing mass in smaller quantities at once, and so somewhat reduce the evil. In some cases, again, the most clumsy of all devices, a fume cremator is employed which is essentially a mass of glowing coke. This, though effectual for destroying the offensive organic vapours arising from the concentration of manurial material and which are necessarily of low temperature, simply betrays by its presence that the destructor to which it is attached has been constructed on erroneous principles.

The inventors of the Acme Destructor, in their design, kept in view the necessity of complete combustion of all the organic matter, and not the merely putting it out of sight and smell. The refuse is tipped into the large receptacle or hopper, from whence it falls through the opening on to the sloping bars, which are set at about an angle of 45°; and as the organic or combustible portion burns out, the residual material gradually falls to the lowest position, whence it is removed by the attendant at the front and side (using a long shanked shovel).

As quickly as it is removed a further quantity falls down the inclined plane formed by the bars, which in its turn is followed by a fresh portion from the hopper. Thus the feeding in of the material is almost as gradual as though rocking bars were employed. The action of the hanging bridge is important; any vapour evolved from the raw material is deflected partly over the surface of, and partly actually through, the already incandescent portion, where it also meets the red hot gases arising from the combustion of the lower portion and becoming ignited, finally passes through the combustion chambers, heating these to such a high temperature that no combustible vapour can escape. As each spadeful is withdrawn it is followed through

the whole system by an equal volume of the raw material, the volatile matter from which being thus slowly evolved has ample time for complete combustion, which cannot be the case where large charges are thrown on at one time. Although designed as a destructor only, it is as capable as any other of being adapted to the generating of steam when the material to be burned contains enough heat-producing material; it equally permits the use of rocking bars, as also the use of a steam or other blower being applied. For the latter purpose it is only necessary to close the front as is usually done and fix the necessary blower or fan.

The inventors of the "Acme" Destructor claim for it:—

1. That it can be constructed at less first cost than any other.

2. That for efficiency, for ease of working, that is the feeding with raw and the removal of burnt material, it offers every advantage.

3. That from its simplicity and freedom from working parts, it is less liable to get out of order than any other, therefore will neither require expensive skilled labour, nor incur frequent stoppages with consequent decrease of working time. Any repairs needed can be done by any ordinary blacksmith or bricklayer.

4. That it effects complete combustion of all carbonaceous or other organic matter in a systematic manner, all vapours having to pass through red hot material and highly-heated combustion chambers, thus rendering the escape of noxious gases impossible.

NOTE.—A paper *On "A Description of some Recent Improvements in Destructors,"* by JOHN A. BRODIE, Assoc.M. Inst.C.E., was also read.

Visits were made to the Liverpool Destructor Works, Hydraulic Power Company's Station, Toxteth Park Destructor Works, and Liverpool Electric Supply Company's Central Station.

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CONFERENCE OF SANITARY INSPECTORS.

The proceedings of the Conference commenced with an address by the President, Mr. Francis Vacher, F.R.C.S., published in Volume XV., Part III.

On "The Local Government Act, 1894," *otherwise called "The Parish Councils Act;" its effect upon the position and duties of the Rural Sanitary Inspector, by* John Aldersey Davenport, M.S.A., Surveyor and Inspector, Nantwich Rural Sanitary Authority.

ABSTRACT.

This subject is sure to have special interest for those who will be affected by the change in Local Government, which will very shortly become an accomplished fact.

Since the establishment of Rural Sanitary Authorities about twenty-two years ago, there has been a tendency to increase the duties and responsibilities of rural inspectors, and this development of work is natural as people become more alive to the necessity for the general observance of those laws of health upon which their well-being depends. The tendency of modern progressive opinion is thus to require more of the Sanitary Inspector. In fact, it seems as if the Sanitary Inspector of the future would have to be almost a doctor, engineer, chemist, and a host of other professions and trades rolled into one.

But whilst more is now desired and expected from this officer, Acts of Parliament have not recognised the desirability of correspondingly improving his position.

The Local Government Act, 1894, is the first Act that has made a great change in Local Government in Rural Districts since the Act of 1872, and it may possibly be fraught with great changes of a beneficial character to the rural inspector; but at present I only find reference to him (and then not by name) in a kind of omnibus clause amongst the transitory provisions of the new Act.

Section 81, clause 1, provides:—"Where the powers and duties of any authority (other than Justices) are transferred by this Act to any Parish or District Council, the officers of that authority shall become the officers of that Council."

Then Clause 4 provides that the office shall be continued upon the same tenure, terms and conditions as heretofore, and at the same remuneration for the same duties. This seems fair,

but that which Acts of Parliament appear to provide, and that which they actually do provide, are not always the same.

Unfortunately nearly all rural inspectors are appointed for limited periods, and the officer's appointment may lapse in a few months after his transference, and then he is out of office. The re-appointment rests entirely with the District Council, and also the terms with respect to it. These times of periodical appointment are naturally times of anxiety to an inspector, but with his old authority he had some feeling of assurance from the past; whereas now there is an unknown quantity before him; those who may be elected are unknown, the course they may take (especially with reference to himself) is unknown, and it is not to be accounted strange if he looks forward with great anxiety to the time of his first re-appointment under the new Council.

Of course it is the intention of the new Act that the Sanitary Inspector shall be placed by it in exactly the same position he held before, but I am afraid that Sanitary Inspectors with periodical appointments will be induced to look upon the prospect as a little worse. The officers of other authorities may also become transferred to the Rural District Councils.

Section 81, Clause 5, provides "that where a Rural Sanitary District is divided by the Act, any officer for the district so divided shall hold his office as such officer for each district formed by the division," and his salary is to be paid proportionately. A Rural District Council may thus have more than one set of officers to perform the same class of duties.

Difficulties in connection with the transfer of existing officers are sure in some cases to arise, and then it follows that some re-arrangements will be required, which may mean the dispensing with the services of some of the officers, and a revision of the duties and salaries of others.

Where any officer suffers pecuniary loss under the Act he will be entitled to compensation, under Section 81, clause 7, and the intention here is evidently to include everybody whose position is affected injuriously by the Act.

Now supposing an inspector is seeking compensation for diminution of salary, the probability is, that whilst he was taking steps under this section or appealing against any decision of his Board, a periodical appointment might terminate, and the claimant might probably find himself without compensation and without office. But if it is desired to get rid of an officer with a periodical appointment without paying him compensation, all that seems needful is, for the new authority to continue his services until its termination, which in any case cannot be long, and then there is an end to both. Supposing he appeals

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to the Treasury according to the provisions of the Act, their verdict in the case of Mr. Watson, Surveyor and Inspector, Burton-on-Trent, who (supported by his own authority) asked compensation for the loss of £40 per annum, caused by portions of his district being taken from him, is not very encouraging. It is as follows:—"Your appointment to the post of Inspector of Nuisances was renewed annually, and was only made for a year on each occasion. In view of this fact, my Lords are unable to award you compensation." The whole system of periodical appointments is wrong, and liable to work injustice to an inspector. Those inspectors who have life appointments, subject to the usual terms, will take no serious harm under the new Act.

All that can be done is to trust to that sense of fair dealing in the new authorities which generally distinguishes Englishmen. It unfortunately happens that the Sanitary Inspector, if he is conscientious, is not unlikely to make enemies, and his position wants strengthening and not weakening. The crisis will be best met by strict and impartial attention to duty, and then with the knowledge of duty well performed, by calmly awaiting the future.

It does seem to me, however, that Sanitary Inspectors should continue to agitate for continuous appointments similar to those enjoyed by other officers who have duties in connection with the Poor Law, or with departments under the County Councils or the Local Government Board.

The duties of Sanitary Inspectors under the new Act will probably not at once be very much altered, but I believe that the Act will in future have a beneficial effect upon the position of the Sanitary Inspector, that it will make hygiene, which has of late years been coming to the front, still more popular. In the future also new duties and powers will no doubt be conferred on the Rural District Councils, and the duties and position of Sanitary Inspectors will grow with the importance of the new authorities, and the general advancement of public opinion in matters of public health.

To sum up, the intention of the new Act is to make no difference in the duties and position of Sanitary Inspectors, but there may be cases of hardship here and there in connection with periodical appointments and re-arrangements under it. Its presence on the Statute Book may however, I hope, be taken as some indication of the awakening of the masses prophecied by Dr., now Sir, Benjamin Ward Richardson nearly twenty years ago, and of a brightening future for health officers generally, and for all.

"*A Resumé of the History and growth of the Sanitary Inspectors' Association, North-Western District, Liverpool Centre,*" *by* J. COOPER, Chief Sanitary Inspector, Liverpool.

ABSTRACT.

PRIOR to the year 1887 there existed no union between Sanitary Inspectors in Liverpool and adjacent districts, and no facilities for the interchange of opinions on questions in sanitary science, and connected with their duties.

To remove these disadvantages a branch of the Metropolitan Association of Public Sanitary Inspectors was formed, the objects being "the promotion and interchange among its members of that species of knowledge and practice which falls within the department of an inspector engaged in carrying out the duties imposed upon him by the Public Health, Local Government Board, and other sanitary Acts, and the general promotion of the objects of sanitary science in connection therewith." These indicate a two-fold benefit—to the inspector and to the public.

The Association is constituted of Sanitary Inspectors in practice, or who have held appointments as such, of Hon. Members elected by the Council, and of Associates, who may be persons holding appointments under Local Sanitary Authorities interested in the objects of the Association.

Such are its objects and constitution, broad and comprehensive, possessing all the elements necessary to fulfil the desires of its founders.

The Association took part in the Congress of Hygiene held in London in 1891, and in the Congress of The Sanitary Institute held at Portsmouth in the following year.

In 1892 Mr. H. P. Boulnois, Liverpool, was elected President, and Dr. Sergeant, M.O.H., Lanc. C.C., Dr. Vacher, M.O.H., Ches. C.C., and Dr. Hope, Asst.M.O.H., Liverpool, Vice-Presidents, Dr. Taylor having resigned.

The Liverpool centre was represented by six delegates at the Conference of United Councils of Scotch and English Associations, held at Glasgow. At the close of the session for 1893-4 the roll of membership showed that the numerical strength was still increasing, the total number being 101.

Space will not permit an enumeration of the lectures, papers, and other proceedings at the various meetings; sufficient to say that science in its relation to the preservation of health has been laid under heavy contributions for the pleasure and profit of the members, and the literature of the Association is

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enriched by special gifts from the knowledge and experiences of its Hon. Members and friends.

When visiting other districts, the inspection of sanitary works and methods is always made the basis upon which the arrangements for the visit are framed; in this way interest is kept alive in the objects of the Association, the Inspector's work is ever kept to the front, and opportunity is afforded of acquiring a stock of useful knowledge, and of comparing methods and practices.

The Association is not a combination with self-interest as its cardinal principle, its members have public duties of a high and important character to carry out; it is their desire that they may more perfectly and completely perform them.

On "*The Difficulties and Drawbacks of the Food and Drugs Acts*," *by* B. Scott Elder, Inspector under the Food and Drugs Acts, Durham.

It was with pleasure that I found myself able to accept the invitation of your Council to read a paper at this important Conference, and that pleasure was certainly increased when I became aware that the subject to be considered was one to which I had given very great attention, viz., the Administration of the Food and Drugs Acts. When, however, I was requested to prepare a paper having special reference to the drawbacks and difficulties connected with these Acts, I felt that there could be no legitimate excuse for refusing to perform a task so easy, and at the same time so absolutely necessary. Special importance is given to this subject at this particular time from a variety of causes. Never was there a time when the subject was so much discussed and considered by local authorities. Never before has the press given such attention and publicity to these matters, and indeed, I may venture to say, that never before have the general public taken such an interest in the Food and Drugs Acts. But it is not from any of these particular "signs of the times" that the present is an exceptionally opportune moment for such a paper, but from the fact that there has recently been appointed a Select Committee of the House of Commons, whose business it is to enquire into the whole working of the Food and Drugs Acts. This Committee as you will know, has already had several sittings, and in response to its own request, will no doubt be re-appointed next

Session, and I venture to say that it is more than possible that the deliberations of this important gathering to-day will come under the observation of some of the gentlemen who compose that Committee, and thus indirectly, if not directly, tend to shape the future Act, in accordance with which our Food and Drugs System will be administered. Regarding then the present as an opportunity not to be lost, I have not endeavoured to make this paper historical, nor yet of an educational nature, but it has been prepared rather as a "plan of campaign," or "brief programme of the immediate future"—pointing out the drawbacks and difficulties of the present Acts, and suggesting ways and means whereby they may be remedied. Permit me to explain that I shall more than once have to refer to my own county, and to cases which have come under my own observation, with the details of which I am perfectly familiar—indeed, I have freely chosen that course rather than refer to proceedings which have come through channels which may or may not be reliable. I therefore make this my apology for referring to my own county.

The Written Warranty.

Passing at once then to the consideration of these difficulties and drawbacks, I would place first and foremost the difficulties of the written warranty. Every Inspector here, knows that Section 25 of the 1875 Act exonerates a defendant if he prove "to the satisfaction of the justices or court that he had purchased the article in question as the same in nature, substance and quality as that demanded of him by the purchaser, and with a written warranty to that effect," &c. I place this foremost on this paper for consideration because it appears to me one of the most important provisions of the Act. At all events it is one which has to be accounted with in almost every prosecution which now takes place within the county of Durham. I frankly admit that I have regarded the production of a written warranty and the institution of proceedings against the person who gave it as a proper interpretation of the spirit of the Act, and I have ever been ready to accept (if I may use that term) anything as a written warranty which could reasonably lay claim to that title, but the question is now fraught with such dangers and nice limitations that I must give it as my firm belief, that if immediate and radical amendment of this Section be not made the whole Act will become a dead letter with regard to many articles of food. I will not trifle with you by asking "What is a written warranty?" as I venture to say that no one here can with any degree of certainty

define what constitutes a written warranty. May it be printed? Ought it to be signed? Should it be dated? Must it contain the word "warranted"?

These and many other questions might legitimately be asked, and almost to each and every answer an equally reliable and direct negative can be quoted. I will not weary you with recitations of what have been presented to me from time to time as written warranties, but I will just mention that the latest and perhaps the most comical written warranty reached me the other day in the shape of a wooden lid from a lard pail containing the words, "warranted pure Kansas, U.S.A.," and the defending solicitor solemnly assured me by letter that he intended to rely upon that as a written warranty!

Apart, however, from the constitution of the written warranty itself, the subject is hedged about with difficulties which dare hardly be referred to in a paper like the present, which may be freely circulated among the general public, indeed, some of the loop-holes I will not even dare to mention, but no doubt they are known to many Inspectors present. However, let me point out that no proceedings can be taken for the issue of a false warranty if the warranty is more than six months old, that being the limit of time for proceedings under the Summary Jurisdiction Act, 1848. It is well known that traders, especially those found in country districts, do not purchase supplies of such articles as pepper and ground ginger every day, but that often these things are in stock for a very much longer period than six months. Just two days ago a case of this precise character, which exactly illustrates the position, was reported officially to me. A tradesman had been discharged from a prosecution (for selling adulterated ground ginger) by the production of a warranty which was quite valid in itself, but on examination it was found to be dated November, 1893, and being therefore ten months old the present machinery of the law was quite unable to bring the offender to justice. I need not enlarge upon this to impress you with the seriousness of this difficulty, and to show how in the hands of some traders the operations of the Acts can be positively nullified.

Another difficulty connected with this question is the place where proceedings must be instituted against the givers of false warranties, *i.e.*, the place where the offence was actually committed. There are not many local authorities who view with delight the prospect of having to go 100 miles for a written warranty prosecution, yet, under the existing statutes such a contingency is extremely probable, indeed, I myself have on more than one occasion had to travel beyond the confines of my own district to carry out my duties in this respect, and never

once have the original prosecution and that for the false warranty been tried at the same court.

There are other difficulties even more serious which indeed I consider even fatal, but acting on the advice of others who are of the same opinion as myself, and having already said enough to show the need of immediate amendment, I will refrain from referring to them. After these observations you will not be surprised to know that I entirely disagree with the Inspector, who, when reading a paper some eleven or twelve months ago, said, "What constitutes a written warranty has now been clearly laid down," nor will you wonder at my utter amazement when I learned that an influential society, after having considered the matter seriously, reported that this Section needed no Amendment!!

To point out these difficulties and drawbacks may be comparatively easy, but to devise ways and means for beneficial and satisfactory amendment is much more difficult. However, as one is useless without the other, let me say at once that I am directly opposed to those who advocate the elimination of the Section altogether. It appears extremely oppressive to throw the onus upon the retail trader, who oft-times has not the means at command to obtain authoritative information respecting the purity or otherwise of the articles he vends.

Two courses appear open, either of which would put an end to the uncertainty which exists at present. First: It might be enacted that a warranty must be given in accordance with a specified form, either on or with the invoice. Second: It might be enacted that the invoice itself should be a sufficient warranty, but in either case the following provisions must be made:—

(*a*) That the warranty must be given by a firm with a trading establishment in the United Kingdom, otherwise it will not be valid.

(*b*) That the expiration of the six months' limit shall be no defence.

(*c*) That, for the purposes of the Act, the warranty shall be deemed to have been given in the district where the adulterated article was purchased by the Inspector.

With one or two additions to these provisions I think that this very vexed question would be placed upon a satisfactory basis, and one which could be understood by traders and Inspector alike; but, before leaving the subject, let me make one other suggestion, viz., that unless the defendant give notice that he will rely upon the written warranty as his *only* defence, he shall be liable to pay the costs incurred by the prosecution.

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It is becoming a very common occurrence to receive notice that the warranty, *amongst other defences*, will be relied on. Such a course puts the Local Authority to the expense of making almost every kind of defence, with a certainty of having a warranty placed in finally, and an application plausibly made to be relieved from the payment of costs on the ground that notice was given. It simply places the Inspector in the position of fighting the air, but there is a very great deal more in the practice than appears on the surface.

Administration.

Another of the grievances and drawbacks is that the administration of the Acts is entirely permissive (as far as the taking of samples is concerned), and that there are actually local authorities who seem to care nothing for their responsibilities in the matter. Were these authorities small and unimportant the evil would be serious enough, but when an examination of the Local Government Board's Returns reveals the fact that some of the largest and most populous districts throughout the country are offenders in this respect, everybody must recognise that there is a missing link somewhere. It is a manifest injustice that spotted over the country, here, there, and everywhere, are large industrial centres in which year after year no samples are taken, and from which emanate the supplies for the surrounding country villages, where under the control of another and more energetic local authority, a strict supervision of the food and drug supply is exercised, and often these practically unoffending country people are punished simply because the neighbouring authority neglects its duty. I contend that such a drawback should not exist, and demands immediate remedy. Where an authority fails to carry out the provisions of the Acts satisfactorily, the Local Government Board should be empowered to give the public that protection which the Acts are calculated to afford, by sending their own Inspector into the district to take samples, and I venture to predict, that if the expenses connected with this procedure were saddled upon the defaulting authority, it would very soon awaken to a sense of its duty.

Somerset House.

As Inspectors we must all feel that another great drawback is the conflict which is continually being waged between the Somerset House Authorities and Public Analysts, on matters of scientific detail, and as the law stands at present one cannot possibly see how these unhappy "passages of arms" are to be avoided. They seem to arise mainly from want of standards,

or absence of precise and definite knowledge as to what should or should not enter into the composition of various articles, and the great misfortune is that at present there is no legally constituted authority which can undertake to give authentic information on these points. The result is that utter chaos prevails, and the effects upon the operations of the Acts are certainly disastrous, as will be seen from the following. Some little time ago a difference of opinion arose between our County Analyst and the Somerset House Chemists, as to the constitution of malt vinegar, and as a consequence my authority have resolved to discontinue, at least for the present, the taking of samples of malt liquor. On another instance, where experts differed as to the constitution of a certain article, my authority looked round in vain to find a court of advice or reference where such a question could be settled, and finally appealed to the Medical Council in London for their opinion; but after waiting some considerable time we received their reply stating that they declined to give their opinion on the matter in question, and as a consequence no more samples of that commodity will be taken in future. Other cases which have come under my own observation might be given, but these are sufficient to show to the most critical the absolute necessity for the establishment of some central authority vested with the power to fix standards, to determine limits, and to define what should enter into the composition of various articles. To this central body local authorities might with confidence submit questions similar to those just referred to, and from it might come circular suggestions relative to new forms of adulteration which may arise, and other information which would be gladly received by local authorities and their officials.

Whether this Central Authority should be blended with Somerset House; whether it should be composed of three or ten members; whether or not they should be permanent officials, are questions which I do not feel it my duty to discuss in this paper, but what we as Inspectors most desire, is a cessation of this continual diversity of opinion between Public Analysts and Somerset House which gives the Inspector so much trouble, and tends very materially to bring the Acts into disrepute; and it appears to me that this end would be attained by the establishment of a Central Authority such as I have indicated, which would be at one and the same time a Council of advice, reference, suggestions, and authority, and would be the key-stone of our Food and Drugs System. As, of course, both the Chemists at Somerset House and Public Analysts d be subject to its decisions, it seems to me to present a tion of a most difficult problem.

Magisterial Indifference.

The leniency with which some Magistrates regard offences against the Food and Drugs Acts is another very serious hindrance to their effective working. No matter how energetic the Inspector, or however qualified the Analyst, it is undoubtedly the magistracy who hold the key of the situation; and it is to be regretted that on many occasions the fines are so ridiculously inadequate, that a tax is virtually imposed upon the Authority taking the proceedings. It has been suggested that a minimum penalty should be fixed, and, while admitting certain difficulties, I am of opinion that it would be very much better than the present system; at all events, it is certainly to be advocated with respect to the issue of false warranties. To fix a minimum penalty is by no means an innovation, as it already obtains in several Acts of Parliament. I have often regretted that the Inspector has no right of appeal to Quarter Sessions. Only recently, after a very long hearing, the Magistrates assembled in Petty Sessions retired, and after considering their decision dismissed the case, and objected to state upon what grounds such dismissal was granted. As the law stands the only person who can appeal to Quarter Sessions is "the person who feels aggrieved by a conviction;" but if each party had the right of appeal, I think that some Magistrates would regard the cases more seriously than they do at present.

The Analyst's Certificate.

In connection with the certificate of the Public Analyst, the drawback I have experienced is that when it is to be disputed, or expert evidence is going to be called to disprove it, it is not incumbent upon the defendant to give due notice to that effect to the prosecutor. At present such a course is optional; many times have I, at considerable trouble and expense, been prepared to meet a strongly defended case when, to my suprise, the defendant has simply entered a plea of guilty, and on other occasions exactly the reverse has taken place; and it appears only fair and reasonable that if the certificate of the Public Analyst is to be assailed he should at least have an opportunity of defending it. Might I here enter a plea for more elasticity in the Analyst's certificate. Recent decisions have so tied the hands of the Public Analysts that to go beyond a bare statement of the ingredients found in the article and to declare an opinion that the same is adulterated is considered exceedingly risky. To my mind no person is more capable of saying whether or not an article is adulterated than the Public

Analyst, and it appears desirable that he should be allowed to say so distinctly on his certificate, and not leave it to the Inspector and the Magistrates to determine. Take, for instance, a case where cream has been abstracted from milk, and find, if you can from the present schedule, where the Public Analyst gets his authority to state that simple fact, and endeavour to frame a certificate which will convey it clearly to the every-day magistrate, and I think you will see the reason for my plea for a more elastic certificate.

The Inspectorate.

Throughout this paper I have repeatedly referred to the officer entrusted with the carrying out of these Acts as the "Inspector," but I need hardly remind you that there are legally no Inspectors of food and drugs. The duties are simply imposed upon Inspectors of various kinds, as well as Medical Officers of Health and police constables, but it is a matter of convenience to refer to them for the time being as Inspectors; and I must confess that I should like to see some provision made to prevent the dismissal (without due cause) of gentlemen appointed to that responsible position. I believe that the Public Analysts are endeavouring to get a clause inserted in the new Act in reference to their own appointment, to the effect that the local authority "shall not remove him during good behaviour, nor reduce his remuneration." Personally, I think a modest provision of that nature with respect to Inspectors would be very acceptable, as there are few officers who receive so many knocks in the dark, especially I believe in Borough districts, as those connected with the purchasing of samples and the prosecutions which so often result therefrom; and I am confident that such a provision would be an incentive to many an Inspector to do his duty fearlessly and conscientiously. It is very desirable that the Inspector should be authorised to appoint in writing a deputy to purchase samples and to go through the formalities prescribed in the 1st clause of Section 14 of the principal Act; and every purchase so made should be deemed a purchase made by the Inspector, and any refusal to sell to the deputy so authorized should be deemed a refusal to sell to the Inspector, and liable to punishment accordingly.

Miscellaneous.

There are various other matters which need immediate attention, but which can only be briefly mentioned in this paper. Referring to condiments, it is necessary that the new Act should state precisely whether or not condiments and

flavouring matters are to be regarded as foods. The Label Question as provided for in Section 8 of the principal Act is not by any means satisfactory, and the amendment of that Section demands very careful consideration, while prosecutions for adulterated drugs are always attended with complications, of the nature of which I am sure you are all aware.

Mr. President and Gentlemen, in bringing this paper to a conclusion, permit me to say that it has been written "by an Inspector for Inspectors," and all matter unconnected with our work, although connected with the Acts themselves, has been rigidly excluded. It is not to be expected that in the short time allotted to me every little grievance could be brought directly under your observation, but I have endeavoured to place before you what appear to me to be the most serious difficulties and drawbacks, and I trust that they will serve as an introduction to our deliberations. Having regard to the fact that in all probability some of us will be asked to give evidence before the Select Committee of the House of Commons, to which I have already referred, I can only express the hope that there will now be full, ample, and careful discussion, so that mistaken ideas may be corrected, and suggestions which present themselves to you as desirable, may receive the seal of your approval.

On "The Power of Inspectors in the Abatement of Nuisances," by W. W. WEST, Sanitary Inspector, Walthamstow.

(ASSOCIATE.)

ABSTRACT.

I DESIRE to direct attention, not to what our powers are, but to what they should be, as the legal powers of inspectors are practically non-existent. I do not wish to run through the whole gamut of our disabilities, but shortly to deal with certain special points.

An application was recently made to a London Magistrate by an aggrieved tenant against an owner for allowing a house to be in an insanitary condition. Applicant was supported by the Sanitary Inspector, who stated his own inability to help, pending the meeting of his authority.

We all agree in acknowledging this position. All the power

is in the hands of the local authority, and however serious or urgent the case, there is no other recognised authority.

Has not the time come for an alteration? In the recent Public Health Act for London, a step has been taken by legalising an official intimation by the Inspector. This is a useful provision, but inadequate, and does not improve matters in urgent cases.

There is much misapprehension as to our powers, and we are commonly believed to have summary powers, until some glaring case dispels the illusion, and we become a laughing stock to the aggrieved parties. This common opinion as to the power we possess is the true indication of the power we should possess, viz: to enter and remedy urgent nuisances.

There is an indication of this in Sec. 49, Public Health Act, 1875, as to removal of manure. Now if such power were needed for the removal of a heap of manure, surely it is so in more urgent nuisances, which may entail more serious results. There may have been good reason for withholding the power in 1875, but thanks to The Sanitary Institute among others, there is now in every district a trained Inspector, qualified to deal with these matters. The exercise of summary power would only be required in rare cases. The knowledge that we possessed such power would in most cases secure compliance with our requests. An official intimation as in the London Act I do not think sufficient, as its main use is the provision of increased penalty, and in these urgent cases our object is not to secure penalties, but to have healthy conditions quickly restored.

It may be said that such powers might be occasionally misused, but there is no reason to believe that mistakes would occur more often than at present, as local authorities do occasionally err, and it must not be forgotten that we should still act as their servants and our proceedings would be subject to review by them.

There is a further power that I think we should possess. There is a large amount of work which by common consent we are expected to do, and do constantly carry out, viz., the prevention of nuisances. The following has been authoritatively given as an illustration of our position in this respect:

"The Inspector has no power to direct or superintend, or to require notice of commencement, and it will be very often finished and covered in before he knows anything about it."

Could anything be more absurd? After weeks of visiting, notices, summonses, &c., the work may be done in an imperfect way, and you may only find it out by making a new inspection. At liberty to begin again. It is surely not asking too much that we should have power to direct or superintend, to have

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notice of commencement, and to see that all is done satisfactorily.

I make these claims, not in the interest of the Inspectors, to whom it only means increase of responsibility, but in the interest of those who look to us to secure those conditions necessary for health, and as a necessary result of our daily experience in matters as to which none have so exact a knowledge, and as to which it is our duty to be outspoken, recognising that "the welfare of the people is the highest law."

On "Some Reasons why the Public Health Acts should be Revised and Consolidated," by W. H. WELLS, Sanitary Inspector, Newcastle-upon-Tyne.

CELLAR DWELLINGS.

CELLARS cannot be, in every way, good sanitary dwellings; therefore sanitary authorities should possess clearly defined powers with respect to them, and the structural conditions of those cellar dwellings which may be separately occupied should be wisely arranged and set forth in unmistakeable language.

The object of my paper is to show that these conditions do not obtain in the existing Statutes relating to such dwellings.

First, then, as to the height of the ceiling above the ground. Section 72, Public Health Act, 1875, requires that it be three feet above "the street or ground adjoining or nearest to the same." Assuming that the words "the same" have reference to the cellar, we have, in the case of a cellar with an "area," the certainty of the ceiling being three feet above the ground nearest to it, which would be the bottom of the area, although it might not be anything above the street; in fact, it might be any distance *below* the street and still comply with the section.

Again—There is absolutely no provision for regulating the depth of the floor below the street; therefore, so long as the ceiling be three feet above the street (regarding for the moment the previously stated difficulty not to exist) it may be occupied, although the floor may be ten feet or any greater distance below. This is a very serious fault in the section, although cases of abnormally deep cellars may not be frequent.

Secondly—As to the width of the "area." As the law now

stands for the provinces, it is doubtful whether, if the area be greater than two feet six inches wide, there is any power to apply the section. But if such power does exist, there must be some width of area where it should cease or be limited, as in the case of an area twelve or fifteen feet wide it would manifestly be unfair to the parties concerned to condemn the cellar with such an "area" for the sole reason that its ceiling be only say one foot above the distant street. Again, there must surely be some width of "area" which would altogether remove a basement room from the classification of a cellar; as, for illustration, if the "area" were fifty feet wide, yet there is no provision for this in the Statute. Also, there should be some height of the cellar out of the ground, at which a lower room should cease to be called "a vault or underground room." We learn from the Statute that if such a room—seven feet high—be three feet out of the ground, it may be separately occupied provided it have, amongst other things, an area two feet six inches wide. What if the "cellar" be six feet out of the ground? or in other words, if the floor be only one foot below the street, is this a "vault"? and would it be illegal to separately occupy this room unless it had an area two feet six inches wide? The law as it stands answers—Yes!

Thirdly —The necessity for a drain in the cellar is not at all clear. One can understand that the "area" should be drained, but why must the drain be continued into the cellar one foot below the floor? What is it wanted for?

It is held to be improper to carry a drain into a cowshed or stable, but here human beings must be differently treated (if so poor as to be obliged to live in a cellar), inasmuch as they are to be compelled to have a drain in their house for which they have absolutely no use.

Lastly—In the penalty section (73) we find that the danger to health of occupying an improper cellar dwelling depends on the payment or receipt of hire or rent; and that so long as no rent be paid or received, any cellar may be occupied or let with impunity, and therefore we assume it is considered to be a healthy dwelling in such a case, whatever its condition may be.

When Dickens' Weller said "The law's a hass," he did not know of this Statute, or he would have used a still stronger term.

I could write much more on this matter, and easily show the whole of Part III. of the Public Health Act, 1875, to be permeated with similar, and in some instances ludicrous, faults and absurdities.

My object, however, is once more to draw the attention of The Sanitary Institute to the defects in our principal sanitary

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Statute, defects so glaring as to render it as a whole an absurdity—a painful, not a mirth-provoking absurdity—when the Statute is considered as the foundation stone of our English Public Health law structure.

It is pitiable indeed to see zealous authorities and their officers struggling to accomplish public good with such inefficient so-called powers—powers indeed!! which tend to stultify rather than to aid their efforts.

Great credit is due to authorities and officers throughout the Kingdom who have accomplished so much as they have with such inefficient tools; but we look with entreaty, nay with demand, to The Sanitary Institute we respect and support, to move decisively and imperatively in the direction of compelling the Legislature to repeal our sanitary comedy and give us sanitary law.

NOTE.—A paper *on "Our Programme; will it enable us to keep pace with the progress of Sanitation?"* by WILLIAM BLAND, was also read.

CONFERENCE ON THE SANITATION OF THE PASSENGER AND MERCANTILE MARINE SERVICE.

THE proceedings of the Conference commenced with an address by the President, Sir WILLIAM B. FORWOOD, J.P., published in Vol. XV., Part III.

On "Port Sanitary Administration" by W. COLLINGRIDGE, M.D., Medical Officer of Health, Port of London.
(MEMBER.)

ABSTRACT.

THE author divides his subject into:—
(i.) Sanitary Work in Port; and
(ii.) Medical Inspection on arrival.

I. SANITARY WORK IN PORT.

He lays down, as a rule, that every vessel arriving should be inspected within twenty-four hours of her arrival at the place of discharge.

ans of comotion *Means of Locomotion.*—In some ports this is a small matter, as the whole of the vessels can be easily reached from quays or landing stages, in others, as in London, where there is a long and straggling water-way, where vessels can lie, rowing boats and steam launches are required. In the Port of London two steam launches and one rowing boat are constantly engaged in the Sanitary Inspection of shipping.

itary pection. The principal points to be attended to in the Sanitary Inspection of shipping are: Forecastles, their position and structure. Every obstacle must be placed in the way of owners providing lower forecastles which are damp, dark, and difficult of ventilation, while every inducement should be given for the erection of deck-houses where these serious defects can be easily remedied.

Ventilation can be easily improved in the majority of cases by a little care and attention to the special conditions.

ble space. The space provided by law is too small—72 cubic feet per head is not sufficient for the normal man to live in and continue in health.

The Law enacting this amount of space is now forty years old, and the time is come when it should be increased to certainly not less than 100 feet per head.

Berths should be in not more than two tiers, the lower one at t 18 inches from the deck, so as to allow of cleansing,

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and the berths themselves properly constructed with a space between them and the side.

Light paint should be freely used so as to make the most of the small modicum of light considered necessary. Decks should be properly drained by means of scuppers, and no drain should run through any closet otherwise than in a closed pipe, so as to prevent effluvia passing into the sleeping quarters. Water-closets should be of the simplest possible description, and in all cases cut off from the forecastle by a tight bulkhead.

Under no circumstances should they be allowed between decks. In steamers they ought to be provided with efficient water flush.

Overhead the decks, if of iron, should be lined with wood or non-conducting material which should be carried down the sides. This will prevent the constant wetting from condensation.

The Board of Trade regulations do not require lining overhead if the deck be sheathed with wood. This sheathing, however, is not sufficient, especially if the forecastle be badly ventilated and warmed.

The floor of the forecastle should be covered with boards tongued and grooved and laid in cement, so as to form a firm, hard, and impervious covering through which dirt and moisture cannot penetrate. Flooring.

The square thin cast iron stove should be at once abolished, and its place taken by a round wrought iron slow combustion stove, lined with fire-clay, and its heat utilized for the improvement of ventilation. Ports and scuttles should be so arranged as to allow light to find its way into every part of the forecastle. Stoves

Wooden casks should be discarded for the storage of water, and galvanized iron tanks coated inside with cement wash, employed instead.

Their manholes should be large, and so placed (where practicable) as to allow of natural light finding its way into them when empty.

Then and then only will they be thoroughly and efficiently cleaned.

All closets and urinals require constant supervision to ensure cleanliness. When a vessel is lying in dock, they should be cleaned and then kept locked, the crew, if standing by the ship, being provided with accommodation on shore.

Every port should have at the entrance or boarding station, a well equipped hospital for the isolation of infectious disease. Hospitals.

This, whether on shore or afloat, must be well isolated, and contain a sufficient number of beds in pavilions or wards isolated from one another, with separate and distinct administration.

ransport.

The means of transport will vary with the position of the hospital, and the arrangement of the port.

In London, the two steam launches used for Sanitary Inspection have each a cabin set apart for the conveyance of infectious sick, and provided with cots and stretchers.

One of these is always within reach of the boarding station. In addition, a covered boat is provided.

For the disinfection of clothing, etc., there can be no doubt that treatment by steam is not only the most efficient, but also the most economical both as regards time and money.

A large size Washington Lyon's is found to be sufficient for the requirements of a large port like London.

pparatus or disinfection.

For disinfection of vessels sulphurous acid gas is used, both in cylinders, and also evolved from the burning of sulphur.

In all cases the spaces are afterwards washed down with a solution of perchloride of mercury (1 in 1000), which is conveniently carried for the purpose in a concentrated solution (35 grs. ad. ℥ i), and diluted when required.

II. Medical Inspection.

Under the present arrangement when a vessel arrives in a British port from "foreign," she is visited by a Custom House Officer who has no medical training, and who does not inspect the crew in any way, but who asks the master of the vessel certain questions.

From the answers given to these questions, such Custom House Officer has to decide the very difficult and important point as to whether the vessel should be at once admitted to pratique, or whether there is any infected person on the vessel, and removal and disinfection are required.

Not only has this essentially professional question to be decided by a layman without inspection, but further, in the event of a false answer being given to such questions, H.M. Customs have no legal power to punish the master for the offence.

Again, if the vessel be found to have any disease on board other than cholera, yellow fever, and plague, no legal power exists for detaining her on sanitary grounds, and the officers of H.M. Customs are therefore instructed not to place the vessel under detention, but to give notice to the Sanitary Officer, *if possible, before any sick person is landed.*

This is obviously a highly dangerous and unsatisfactory state of things, and theoretically must always lead to a danger of importation of disease.

By the Cholera Regulations, 1890, power is given to the

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Medical Officer of Health to inspect any vessel, if believed to be cholera infected, or if she has come from a cholera-infected place, whether she has previously been examined by Custom House Officers or not.

Realizing the inadequacy of the former arrangements for the proper protection from importation of disease, the Port Sanitary Authority of London, acting under my advice, and in conjunction with Her Majesty's Customs (who, impressed with the necessity, give every facility), has instituted a very simple system of medical inspection which has now been in force for two years, and which has worked well without the slightest unnecessary delay or hindrance to the trade of the Port.

This last point is a very important one. If you are to secure the goodwill and co-operation of the shipowners and masters, you must begin by showing that no undue restrictions will be placed upon the coming and going of their vessels.

Briefly, the system is as follows: A hulk is provided and fitted up as a residence for a Medical Officer, who is always on duty by day and night.

Three Medical Officers perform this work, each being on duty for twenty-four hours at a time. The Customs' launch takes the Medical Officer to every ship.

He hears the questions put, interrogates the masters with special reference to the particular port from whence she has arrived, medically inspecting whenever there is any reason for suspicion, and invariably if the arrival be from an infected port.

He also inspects the log book and sees any person who has been ill on the voyage, whatever the nature of the illness may have been.

If any person be sick at the time he visits him, he decides as to the nature of the illness; whereas formerly the Custom House Officers had to receive the diagnosis of the master on oath.

The master of a vessel cannot be capable of deciding as to the nature of an illness, and he may possibly be interested in concealing even its existence. If there be a case of infectious disease on board, the boarding Medical Officer directs and superintends its removal to hospital, and orders the Sanitary Inspector to at once carry out any disinfection necessary, to see that the water tanks are emptied and clean, and that the bilges are disinfected and pumped dry.

The economy to the shipowner is great, there is no waiting for the Medical Officer to be sent for, no waiting for the removal of the case, and the danger from the presence of infection is as far as practicable averted.

Now as to practical results. In a previous report to the Corporation, I have shown that during the past two years the

number of cases of infectious disease detected and removed at the entrance to the port is now about seven times as many as before the system was in force.

Clearly, therefore, either the amount of infectious disease has enormously increased (and this there is no evidence to prove) or else a large number of cases have been removed which previously, owing to the want of medical inspection, were allowed to pass and find their way into London. How far outbreaks in the Metropolis may have been due to such importation it is difficult to say, but at any rate the possibilities were many and great.

I would therefore, in the interests of Public Health, strongly urge the adoption by all Port Authorities of this simple and inexpensive (bearing in mind the efficiency) system of medical inspection.

I would here call attention to the report of Dr. Blaxall to the Local Government Board in 1886, in which he says:

"I would suggest for the consideration of the Board, the expedience of inquiry into the health of *all* vessels on arrival being placed in the hands of the constituted Health Authority." With the results of practical experience before us, Dr. Blaxall's remarks are indeed worthy of the most careful and earnest attention.

He goes on to say: "Such inquiry by an officer appointed by the local Sanitary Authority, instead of by the Customs, would not hinder trade."

"Usually the Health Officer and the Custom House Officer would go off to the ship together, inquiry by the Health Officer taking precedence, however, over the inquiry made for the purposes of Revenue."

I have already shown that so far from hindering, it greatly facilitates the free passage of vessels, and saves much time to the shipowner.

Practically, therefore, I would advise that the health inspection be handed over to the Local Authority, who should be required to provide the necessary medical staff; while the officers of Her Majesty's Customs, relieved from this heavy responsibility, for which they have no adequate machinery, should utilize their launches for carrying the Medical Officers in making their necessary visits on arrival for revenue purposes.

The vessel would be granted or refused clearance by the Medical Officer; in the former case, the Custom House Officers would at once proceed with their duties, and in the latter the vessel would be detained by the Local Authority until the necessary removal of patient or disinfection had been carried out.

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Her Majesty's Government has already decided that yellow fever and plague should be handed over to the Local Authority and dealt with in the same manner as cholera is at present. In order to bring this about, legislation will be necessary, and it seems highly desirable that when so important a step is being taken, the opportunity of putting the whole question on a sound and scientific basis should not be lost sight of.

When once quarantine is abolished the matter becomes very simple. A vessel is either infected or non-infected on arrival; if "infected" she must be "disinfected." This is only a matter of a few hours if adequate machinery be provided. If non-infected there is no reason why she should be detained simply because she has come from an infected port, and ought to be allowed at once to proceed to her destination. Here, as in most other cases, science and commerce are hand in hand. The shipowner has already a sufficiently heavy burden to bear, and it certainly ought not to be unnecessarily added to.

In the interests, therefore, of the trade of the country, let us urge the general adoption of medical inspection, which undoubtedly, with the minimum of interference with shipping, combines the maximum of protection to the public health.

On "*The Health of Seamen and of Mecca Pilgrims as Illustrated by Ten Years Medical Statistics of the Ocean Steamship Company*," by BRIGADE-SURGEON LIEUT.-COLONEL E. NICHOLSON, D.P.H.

ABSTRACT.

I. SEAMEN.

STATISTICS of disease and mortality in the Mercantile Marine are absolutely necessary as the basis of any scientific discussion on the health of ships' crews. Not being aware of any, I have endeavoured to supply the deficiency to some extent by compiling the records of a fleet of steamships in the China and Java trade; every one of these ships carries a surgeon whether passengers be carried or not; and the arrangements made for the medical care of the crews (averaging a strength of about one thousand hands always at sea) afford the means of obtaining accurate statistics.

In the following table, the sickness and mortality are given in comparison with those of the Royal Navy.

	R.N. (1890)	Ocean SS. Co. (1884—93)
Av. daily sick per 1,000	42............	{ 8 China line {13 Java ,,
Av. sickness a man a year.........	15·4 days	{ 3 days China line { 5 ,, Java ,,
Av. mortality per 1,000	8·5	{8·6 diseases and injuries. {1·8 drowning and suicide.

The preponderance of sickness in the Navy is doubtless due to men being placed on the sick list for many ailments which do not materially affect working capacity. It is so in the army where, for the year 1890, the above three averages were, for the whole army, 59, 21 days, and 9; on the China station they were 51, 18 days, and 9·6.

The total incidence in each year is fairly uniform, and for each voyage (of about four months) it averages for the whole crew (about 42 in number), 42 cases of disease treated, and 45 days of sick list.

While remittent fever was the principal disease in Java ships, other diseases were fairly uniform in both lines.

	41 China voyages.	30 Java voyages.
A.D.S. per 1,000 from Malarial fevers	0·5	6·2
A.D.S. per 1,000 from all other diseases	7·6	6·9

Causes of Deaths (10 *years*—1884-1893) *including deaths on shore when landed sick*:—

Malarial fevers	4	Fireman's cramps	3
Enteric fever	3	Heat apoplexy	10
Small-pox	3	Epilepsy	1
Cholera	22	Inflammation of brain ...	1
Lung diseases...............	5	Alcohol	5
Tubercular ditto............	8	Injuries	7
Heart ditto...................	3	Scald	1
Kidney ditto.................	1	Drowned and missing ...	14
Beriberi	1	Suicide	4
Dysentery	4		
Gastric ulcer	1		102
Typhlitis......................	1		

The annual ratio per 1,000 on the above is 10·4, from disease and injury only, 8·6.

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II. Mecca Pilgrims.

One hundred and forty-six voyages are recorded, in which 52,072 Moslem pilgrims, of all ages and both sexes, were conveyed to or from Jeddah in the Red Sea.

In 85 voyages, conveying 28,507 pilgrims to Jeddah, principally from Singapore and Java, the total deaths were 87, equal to 3 per 1,000. The deaths were principally from old age and chronic diseases, none were from infectious disease. Only in three voyages did any of the latter appear—viz.: 3 cases small-pox and 1 enteric fever.

In 61 voyages, conveying 23,565 pilgrims back from Jeddah to their homes, the deaths were, from ordinary disease 142, from infectious diseases 15; total 157, equal to 6·6 per 1,000.

In 40	of these voyages,	no infectious disease.
„ 1	„	cholera, 2 cases, 2 deaths.
„ 19	„	small-pox 63 cases, 13 deaths.
„ 1	„	enteric fever, 1 case, 0 deaths.

The only deaths among the crews from infectious disease contracted from the pilgrims were in the single cholera voyage, when 6 men caught it, of whom 4 died.

On "The Medical Department of the Mercantile Marine Service," by C. H. Leet, F.R.C.S.

ABSTRACT.

The Author described the duties of Ship Surgeons towards the Port Sanitary Authorities as very serious and responsible. On arrival at a home port the Ship Surgeon is required to hand to the Customs Officer a medical Certificate signed by the Commander and himself, reporting any deaths, sickness on ship board from infectious or contagious disease, &c. The Ship Surgeon, precariously holding his office at the will of the shipowner, is under the nominal protection only of the Board of Trade in carrying out the laws of nautical hygiene, which must often necessarily involve expense on the part of the shipowner his master. He is exposed to the temptation of minimising the danger of infecting the port by waiving doubts in cases of

difficult diagnosis, and so may risk a clean bill of health, to the relief of the captain and in the interests of the shipowner. Hence this is palpably the weakest link in the chain of our first line of defence against the importation of infectious disease into these realms, and the strongest argument for conferring an assured position under Government protection and control upon Medical Officers in the Mercantile Navy.

He next described the Ship Surgeon's duty to his employer and paymaster, the shipowner, with whose Medical Superintendent rests the responsibility of selecting and instructing the company's surgeons in their sanitary duties on shipboard at sea.

He urged that this official should be under Government control, instances having occurred of the shipmaster interfering at sea with the medical duties of the surgeon of the ship, and on arrival home, of the latter receiving no redress either from Medical Superintendent or shipowner, the Board of Trade also not having the necessary powers to interfere on his behalf with the decision of the shipowner.

He then read two official letters he received from the Board of Trade in August, 1894. In one the Board state that they have not issued regulations or instructions dealing with medical officers in the mercantile marine, while in the other letter the Board state that the printed sanitary Instruction Paper "is in use, has not been altered, and is handed by their Emigration officers to the surgeons of vessels clearing under the Passengers Acts." It appears that some shipping officials have issued for many years to their surgeons a "revised version" of this Board of Trade document, to the surprise of the medical and lay journals, who contend that such action conduces to lower H.M. Board of Trade in the estimation of the ship surgeon, encourages him to shut his eyes to insanitary conditions in the ship, and ties his hands in the matter of suggesting hygienic precautions.

Such a serious state of things palpably demands reform, and the Author recommends that powers analogous to those of his professional brother on land—the Medical Officer of Health—should be conferred upon the ship surgeon under Government control; or better still, to organize a Medical Marine Service, so frequently urged for years upon all European Governments by the Quarantine Authorities at New York.

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On "The Atlantic Cattle Trade," by S. G. MOORE, M.B., Assist. Medical Officer, Liverpool Port Sanitary Authority.

(MEMBER.)

ABSTRACT.

THE date of commencement, growth and present importance of the trade, countries from which cattle are brought, means of transport, veterinary inspection of the cattle on behalf of the U.S. Government; its object and efficiency.

The cattle ship, size and number; regulation with regard to:—

(*a*) Registration. (*b*) Cattle pens. (*c*) Space per head. (*d*) Number of decks on which cattle may be carried. (*e*) Protection of cattle from weather. (*f*) Ventilation. (*g*) Hatches. (*h*) Food carried on deck. (*k*) Water supply. (*l*) Number of attendants. (*m*) Tethering of cattle. (*n*) Provision of foot-locks. (*o*) Strength of materials for cattle fittings.

Inspection of, object of regulations secured, percentage of deaths among cattle in transit, description of cattle deck when occupied, absence of provision for cleansing, suggestions.

Regulations on arrival to exclude contagious cattle diseases, prohibited countries, "free" countries, foreign animals wharves, arrangement, etc., detention for inspection of animals from "free" countries. Conclusion.

The Atlantic cattle trade, at this time of such magnitude and importance, is of comparative recent growth, the first cargo of live cattle brought to this port from the American continent having been landed in the year 1874—just twenty years ago. The numbers carried at first were quite inconsiderable, and owing to heavy losses due to deaths in transit, the trade for some time gave little promise of reaching anything like its present proportions. In the sixth year after its commencement we find that 31,800 animals were landed, and in 1892, 202,064. That is to say in thirteen years the volume of this branch of commerce had increased nearly seven-fold. At the present time a fleet of no fewer than 71 large steamers is engaged in the trade, and from them cattle were landed at the Woodside and Wallasey lairages on 414 occasions during last year, discharging an average of 500 head on each occasion. A single steamer brought on one voyage 1170 beasts.

The majority are from the United States, but considerable numbers come also from Canada and the Argentine Republic; thus in 1892 of the total number landed here 74·5 per cent.

were from the former country. During the same period of the total exported from the United States, Liverpool received 40 per cent.

The animals, bred and raised largely in Illinois, Indiana, Texas, and Wyoming, are sent partly by road and then by rail to certain centres known as stock-yards, of these the principal are at Chicago.

Here each is submitted to a careful inspection by Veterinary Surgeons, who are officers of the U.S. Department of Agriculture. These gentlemen obtain and record the history of each animal, and having done so attach to the ear a numbered tag. The number corresponds to that in a record book kept for the purpose, in which are entered:—

(*a*). A description of the animal.

(*b*). The state, district, and ranche where bred and raised.

(*c*). Name of the breeder and the owner.

The beasts thus collected are dispatched by rail to the seaboard where, after a delay of twenty-four hours imposed by law, and a second veterinary inspection, they are placed on board the cattle ship.

This system of tagging and veterinary inspection is completed by an inspector stationed at the ports of debarkation, who examines the animals on board the vessel on arrival, and again, so far as practicable, as they are slaughtered.

In case of disease being present he examines, and obtains specimens of the viscera, and makes a report of the result.

The object of the system is to enable the department to trace cases of contagious diseases to their origin. Thus, if an animal on landing or slaughter were found to be suffering from such disease, the veterinary inspector here would cable the number marked on the ear-tag to the head of his department in the United States, who, by reference to the records kept at the stock-yard, would be able to ascertain on what ranche the animal had been raised, and also knowing the date and route by which it had travelled, the animals with which it had been in contact. It speaks well for the efficiency and reliability of this system that a correct description of an animal, with a statement of its place of origin, was received in Liverpool 4½ hours after the number taken from its tag had been cabled to headquarters.

The vessels engaged in the Atlantic cattle trade are large and powerful steamers, ranging from 2,000 to 5,000 tons gross register. They carry other cargo, but are specially fitted to accommodate cattle in conformity with regulations made by the Department of Agriculture, under the authority of an Act of Congress of the U.S., dated in March, 1891.

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The following is an account of their chief provisions:—

Each vessel must be registered.

A certificate of registration is given, and is liable to cancelment upon violation of the regulations.

The cattle must be enclosed in pens, not more than four in each, there must be a passage or alley way between each row of cattle not less than 18 inches wide, and each animal must be allowed a deck space of 2 feet 8 inches by 8 feet.

Cattle may be carried on three decks, but where it is intended to carry on a third, special permission must be obtained, and special arrangement made in respect of the lowermost. If animals are carried on a spar-deck the pens must be covered in, so as to afford protection from weather.

With regard to ventilation:—

Each compartment must have at least four bell-mouthed ventilators of not less than 18 inches inside diameter, with tops exceeding 7 feet in height, two situated at each end of the compartment. Cattle may not be carried in alley-ways alongside engine-rooms unless the latter are sheathed with wood $1\frac{1}{2}$ inches thick, leaving a 3-inch air-space. The hatches covering decks on which cattle are carried must be kept clear of other cattle and merchandise.

Only two days' feed may be kept on deck; it must be properly covered and used first.

All vessels must carry not less than four hogsheads of over 100 gallons capacity for each 100 head of cattle. These must be filled with fresh water before sailing and refilled as emptied.

One attendant for every twenty-five head of cattle must be carried; three-fourths of the men must be experienced, and have made previous trips in the same capacity.

Each animal must be tied by the head with a $\frac{3}{4}$ inch rope, which may not be used more than once.

Foot-locks or battens must be provided, and securely fastened to the deck at specified intervals, and ranging fore and aft of the ship.

The strength and nature of the materials of which the cattle fittings are made, as well as their arrangement and method of fixing, are carefully detailed, and special inspectors are appointed at the port of embarkation to see that the foregoing regulations are duly complied with.

It is barely necessary to remark that the arrangements on board most of the steamers are in excess of these requirements. The allowance of water is greater (some steamers are fitted with condensers) more ventilation area is provided, and the lower decks are specially lighted, so that the tending of the beasts during the voyage may be better performed.

The object of the regulations, to ensure the safe transport and humane treatment of the cattle, is well attained. They lie down, feed well, and arrive in good condition. The total numbers lost from all causes (heat, exposure, and accident) represented in 1891 a percentage of 1·6, in 1892 0·87, while for the first eight months of 1894, it has fallen to 0·21 per cent. A result which is undoubtedly very creditable to this branch of the cattle trade.

On descending to the deck of a vessel carrying cattle, at first there is little to be seen through the prevailing gloom, but after a while one can perceive extending on all sides, and standing or lying closely together, row after row of oxen, four deep across the ship, and above their backs a forest of wooden stanchions. The first row is along the side of the vessel, next comes an alley-way, and then another row, the heads of animals in each being towards the alley-way; and so on to the other side of the ship. Between every four cattle, stout planks are fixed between the upright stanchions, forming the pens.

One thing is entirely neglected on cattle ships—viz.: the removal of dung. From the time the animals are taken on board, until they leave, no provision for cleansing is made. As a consequence, a condition arises which can better be imagined than described. It is enough to say that a cattle-steamer often makes her presence known to the olfactory sense while she is yet a considerable distance away, and that frequently the ammoniacal smell between decks is simply overpowering to those not inured to it. I have not, however, known the eyes of cattle to be influenced by it to such a degree as to cause distinct inflammation of the conjunctiva.

This neglect to cleanse the cattle surely ought to be remedied. By means of the ordinary appliances found on board every steamer—I refer to the steam pumps and hose—the pens might be washed down every morning. The upper decks would drain directly overboard through the scuppers, and conduits having their apertures covered with gratings might be carried from the lower decks to the bilges, which could be pumped out in the usual manner.

On arrival here the animals are subject to another set of regulations, framed with the object of preventing the introduction into this country of contagious cattle diseases.

For this purpose stock-raising countries are arranged in three divisions, viz.:—

Those from which cattle may be landed and pass into the United Kingdom.

Those from which cattle may not be landed at all, and

Those from which cattle may be landed for slaughter.

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The only countries in the first division are New Zealand, Iceland, Channel Islands, and the Isle of Man; cattle imported from these may be disembarked at spaces technically called Landing Places for Foreign Animals, and after a detention of twelve hours for purposes of inspection, may travel to any part of the Kingdom without further restriction, but the cattle and the vessel in which they are brought must not have been in, nor in communication with, any port or place in any country from which the free importation of cattle is for the time being prohibited, within periods the duration of which is specified for each country affected.

The cattle-raising districts from which the importation of stock is entirely prohibited are:—All European States, Morocco, Malta, Natal, Zululand, and the Portuguese State of East Africa.

The third division comprises all other countries, and includes those from which practically all the foreign cattle imported are brought. Such cattle must be landed at certain enclosed spaces, technically—Foreign Animals' Wharves, and must be slaughtered within a period of ten days, exclusive of that on which they were landed.

Until the year 1892 cattle from Canada were not subject to slaughter on landing, but in that year owing to *pleuro pneumonia* having broken out among Canadian cattle landed here, it was found necessary to cause them to be landed at Foreign Animals' Wharves, where, of course, they must be slaughtered.

Foreign animals' wharves are under the direction of an Inspector of the Board of Agriculture, and are subject to stringent rules providing for the reception, disposal, moving, feeding, watering, and slaughter of cattle landed thereat, as well as for cleanliness, the disposal of litter, manure, and offal, and when necessary for disinfection. Special rules to meet possible outbreaks of each of the contagious diseases of cattle are also framed.

Cattle landed from "free" countries are detained for inspection for twelve hours, after which period they may proceed into any part of the country, but manure, litter, fodder, &c., are liable to the same regulations as if they appertained to animals from other places, and in case of disease being detected among them they are liable to immediate slaughter.

On arrival in these wharves, cattle are placed in large pens arranged in rows with a broad alley-way between, are provided with water, and unless they are to be slaughtered immediately, with fodder also. They are left at rest for at least ten hours prior to being killed, otherwise they would bleed imperfectly, and the flesh would not set well or keep, so that even if placed

promptly in a refrigerating chamber the flesh would rapidly become dark in colour and unsaleable. From these pens they are driven to the slaughter-floor whence after killing and dressing they can be run, slung on hooks by means of pulleys, without further handling, to sale rooms, refrigerating chambers, carts, or to railway trucks, for distribution throughout the country.

In conclusion I wish to refer to an aspect of the subject which, though more particularly of interest to economists, indirectly is of interest to all concerned in problems having relation to the communal health, since to *this* an abundant supply of good food is of the greatest importance.

In the cattle brought to England from the American Continent we have a large, and an increasing supply—of excellent quality—of one of the great food stuffs, and it is to the last degree necessary that such supply should become available to the people at moderate prices.

Now, the killed and dressed carcases of beef can be purchased wholesale in the lairages at prices ranging between 3½d. and 5d. per pound, and one cannot help feeling, especially in view of the large quantities dealt in, that the prices realised in the retail butchers' shops do not bear that close ratio to cost which obtains in other trades where the quantities dealt with are large, and where the turnover is also rapid.

On "The Ship considered as a Dwelling," by FELIX B. O'FLAHERTY, M.B., D.P.H.

ABSTRACT.

IN comparing the house at sea with the house on shore, we notice that there are the same sanitary evils to be avoided—dampness, darkness, foul air and dirt.

The house on shore is freed from dampness by draining the site and by suitable construction. The other evils are avoided by proper arrangements.

At sea the site cannot be drained. Dampness is always present, but it must be kept down to the lowest possible amount. It was shown last century that the dryest ships of a squadron showed the smallest sick lists, just as Buchanan showed that to drain the site of a house was to reduce the death-rate, especially the phthisis death-rate. In accordance with this fact there

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should be no needless wetting of the ships' decks or living apartments. Leaks in the decks must be caulked, hawsepipes well blocked; dry methods of cleaning should be employed as a rule, and when scrubbing must be done hot water should be used and the place quickly dried, even by using artificial heat.

Darkness and dirt are usually associated at sea as on land. No greater improvement has been effected in ship sanitation than the substitution of deck forecastles for those between decks. In some new sailing vessels there is a still further improvement. The men have a deck house amidships, and under the forecastle head bath rooms and closets are fitted up. The sanitary advantages of the deck house are obvious, but there are difficulties in the way of their employment on steamers. Anybody who can compare the deck forecastle with the dark foul den between decks, will readily grasp how great the improvement has been.

The amount of air space allowed by the Board of Trade regulations is entirely insufficient (54 cubic feet when hammocks are used, 72 cubic feet with fixed bunks). Fortunately most ships allow more room than this in the forecastles, but still not enough. This amount would make it necessary to have the air changed every minute and a half.

The Stewards on large passenger steamers used often to suffer from insufficient accommodation, and consequent poisoning by impure air. The amount of room specially set apart for Stewards each voyage might be inquired into with advantage by the Board of Trade Inspector.

It would be well if Captains made a daily sanitary inspection of the living rooms of the crews, just as they do at present through the steerage of an emigrant vessel.

Besides pollution of air from insufficient ventilation, there is sometimes pollution from offensive cargoes. This must be remedied by having the bulkheads in perfect condition, and by suitably stowing the cargo.

The bilges, which correspond to the drains of a house, must also be kept clean, or they will give rise to discomfort and disease. Leakages into the bilges and drainage from moist cargoes can be pumped out by well-fitting pumps. The bilges and bunkers must be well cleaned before the voyage, and ventilated by windsails or otherwise during the voyage. The bilges should be kept as dry as possible, and salt water especially kept out, because of the formation of sulphuretted hydrogen and other gases from the sulphates in the sea water.

The means of ventilating a ship are more difficult to apply than on land. Natural ventilation fails in bad weather, when the ports must be kept closed, and also in warm weather, when

there is no breeze; and, the temperatures being the same inside and outside, there is no motive power to effect the change of atmosphere. Artificial systems of ventilation have their uses, but are all likely to fail in certain movements of the vessel.

Special care is generally taken with the stokehole ventilators, and is necessary because of the dangers of fainting, or even heat apoplexy which the firemen risk.

There is no sewer problem at sea, and no quarrel between different methods of dealing with excreta; but the sanitary closet accommodation on board has greatly improved in recent years.

The formation of a class of ship sanitarians has had the happiest results in the last twenty years. They point out dangers not at once obvious, and therefore likely to remain unguarded against; and from their success in the past, we may confidently expect further improvement in the future.

"*Memorandum on Precautions against Infectious Diseases in Ships not carrying a Surgeon,*" *by* W. G. ROMERIL, Sanitary Inspector, Port of London Sanitary Authority.

(ASSOCIATE.)

ABSTRACT.

POINTING out the need of sanitation as required by a shipmaster, as part of his ordinary duties, in safeguarding the health of the crew, and minimising the danger of infection on board his vessel.

Desirable that sub-sections of Section 282 of the Merchant Shipping Act, 1854, be amended, to ensure sanitary precautions being taken.

Fevers common to the East Indies, such as Jungle and Java fevers, &c., are treated more or less as non-infectious, with the result that sick and healthy men occupy the same berth or forecastle.

With cholera the same carelessness applies.

The average shipmaster gradually becoming educated as to the beneficial results of good water, still too often indifferent as to quality; on the other hand a victim of circumstances,

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being glad to get water where he can. All vessels going east of Suez Canal should condense for supply.

A few instances given, from personal experience and otherwise, as to water being the source of infection.

Indiscriminate trade in tropical fruits, as carried on by Bumboats in those climates, giving the dangers of infection.

Sleeping on deck in tropical climates is mainly attributable to the following causes:—

(1). Insufficient space;
(2). Lower forecastles;
(3). Berths too near engine room and stokeholds.

The master to be at liberty to refuse deceased seamen's effects put on board by British Consuls or Shipping Masters at Colonial ports, unless accompanied by a certificate of disinfection, if cause of death was attributable to infectious disease.

Effects of seamen dying on board not to be sold.

Careless manner as to the way medicines are issued on board some vessels, will not bear investigation.

Disinfectants as required by Act inadequate.

Rules for the guidance of shipmasters, with a view that the same be submitted to the Board of Trade, as a supplement to the official log.

NOTE.—The proceedings of the Conference of Ladies on Domestic Hygiene were printed separately in pamphlet form, and can be had on application at the Offices of the Institute, price One Shilling.

RESOLUTIONS PASSED AT THE CONGRESS HELD AT LIVERPOOL, 1894.

DURING the Congress resolutions were passed at the various meetings, and were in due course submitted to the Council of the Institute. After careful consideration certain decisions were come to by the Council, which are set out below following each resolution.

As the various meetings at which the resolutions were passed cannot now be informed of the action taken, the Council thought it well to set them out here for the information of those interested.

RESOLUTIONS PASSED IN SECTION 1.—SANITARY SCIENCE AND PREVENTIVE MEDICINE:—

1. "That this Section approves the conclusions of Ald. Burt's paper on the Laws relating to the Acquisition of Land for Isolation, Hospitals, Workmen's Dwellings, and public improvements, and recommends the Council of The Sanitary Institute to take measures to secure the early adoption thereof."

The conclusions in Mr. Alderman Burt's paper were:

I. That orders of the Local Government Board and of County Councils (subject to confirmation by the Local Government Board) for compulsory acquisition of land required by local authorities for public purposes, made after due notice and public enquiry, should have the force of the law without an Act of Parliament.

II. That application for such orders may be made at any time on giving the prescribed notices, instead of being confined as at present to the months of September, October, and November.

III. That the abolition of the additional price for compulsory sale should be extended to all the above cases, and the Betterment Clauses of the Housing Act of 1890, or some analogous provisions applied thereto where appropriate.

IV. That the provisions of the Act of 1894 as to costs of counsel and witnesses should also be made of general application.

V. That the Local Government Board or the County Council, as the case may be, should be enabled to exclude the operation of Section 92 of the Lands Clauses Act, 1845, in any cases where they think fit to do so.

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VI. That County Courts should be authorized to deal with all compensation cases up to £500, and that all the authorized tribunals be enabled to dispose of the claims of owners, lessees, and occupiers, in respect of the same property at one and the same time.

Resolutions of the Council of the Institute.—"That the Council are not prepared to support the suggestion for so fundamental a change in the existing law as suggested in Paragraph I."

"That the Council agree with the suggested extension of time in Paragraph II."

"Paragraphs III., IV., V. and VI. have no direct bearing upon Public Health, and it is, therefore, not in the province of the Council to express an opinion upon the suggestions made."

2. "That this Section recommend the Council of The Sanitary Institute to take steps for obtaining the action of Local Sanitary Authorities to disseminate a knowledge of the Infectious nature and the means of preventing the spread of Tubercular disease."

Resolution of Council.—"That the Council are of opinion that it is very desirable that the public should be enlightened as to the communicable nature of Tubercular disease; they think however that it would be undesirable for the Institute to take any action in the matter until the Report of the Royal Commission on Tuberculosis is issued."

Resolutions passed in the Conference of Medical Officers of Health:—

3. "That this Meeting is of opinion that in the interests of the Public Health of the Country:

i. "It is no longer expedient that appointments as Medical Officers of Health and Inspectors of Nuisances should be made for limited periods of time.

ii. "It is desirable that the powers of the Local Government Board with regard to tenure of office should be extended, so as to apply equally to all Medical Officers of Health and Inspectors of Nuisances, whether they be paid entirely out of Local Rates or not, and that these Resolutions be referred to the Council of The Sanitary Institute to deal with."

Resolution of Council.—"That the resolutions be approved and submitted to the Local Government Board, together with

similar resolutions (Nos. 7 & 8) passed in the Conference of Sanitary Inspectors set forth below."*

The following Suggestion was made in the Conference of Municipal and County Engineers:—

4. "That it is desirable that an impartial Committee of Engineers should be appointed with a view to making practical Tests as to the efficiency of certain apparatus about which there is a divergence of opinion, and to obtain reliable data therewith in the same way as the Committee constituted by the British Association."

Decision of Council.—"The Council would point out that the action suggested, is already the practice of the Institute, for in addition to the Testing Committees appointed in connection with the Exhibition, Special Committees of investigation have from time to time been appointed, and funds voted for experiments where definite matters of sanitary importance have been brought under the consideration of the Institute. The suggestion does not refer to any special apparatus, and the Council are not therefore in a position to take any action upon it. They have decided, however, to communicate with the Secretary of the Conference and point out what has been the practice of the Institute, and to say that a definite proposal for any particular investigation would be fully considered by the Council."

Resolutions passed in the Conference of Sanitary Inspectors:—

5. "Proposed to recommend the Council of The Sanitary Institute to print Mr. Scott Elder's paper in extenso."

Resolution of Council.—"That Mr. Scott Elder's paper be printed in full in the Journal."

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* A deputation was received by Sir Walter Foster, M.P., at the Local Government Board on March 8th, for the purpose of discussing the question of the appointment and tenure of office of Medical Officers of Health. The deputation consisted of representatives from The Incorporated Society of Medical Officers of Health, The British Medical Association, The British Institute of Public Health, and The Sanitary Institute. The Institute was represented by the Rt. Hon. Earl Fortescue, Mr. G. J. Symons, Mr. T. W. Cutler, Mr. T. de Courcy Meade, Dr. Louis Parkes, and Mr. H. Saxon Snell, and the Secretary. A a copy of the above Resolution, passed by the Council of the Institute, was submitted.

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6. "That the Council of The Sanitary Institute be recommended to the matter of the propriety of all Sanitary Authorities discharging the expenses of all Sanitary Inspectors or Inspectors of Nuisances in attending Congresses organised by the Institute, and to take steps for obtaining the sanction of the Local Government Board to the payment of such expenses by Sanitary Authorities."

Resolution of Council.—"That it does not appear to the Council that the sanction of the Local Government Board is necessary to enable Sanitary Authorities to pay the expenses of their officers in attending the Congress, and as the papers read and the discussions upon them at these meetings would undoubtedly be of great value to Sanitary Inspectors, the Committee think that Sanitary Authorities would find it very advantageous to send their Inspectors to the Congresses of the Institute and the Sanitary Exhibitions held in connection with them."

7. "That it is no longer expedient that appointments of Medical Officers of Health, Sanitary Inspectors, and Inspectors of Nuisances, should be made for definite periods of time."

8. "That it is desirable that the powers of the Local Government Board with regard to tenure of office should be extended, so as to apply equally to all Medical Officers of Health, Sanitary Inspectors, and Inspectors of Nuisances, whether they be paid out of the Local Rates or not."

(See decision on similar Resolutions passed at the Conference of Medical Officers of Health.)

9. "That it is desirable that County Councils should have the power of making representations to the Local Government Board either for or against the dismissal of such Medical Officers of Health, Sanitary Inspectors, and Inspectors of Nuisances, as are partly paid by such County Council, and that the Council of The Sanitary Institute be recommended to forward this resolution to the proper authorities."

Decision of Council.—"The Council know of nothing to prevent County Councils making representations to the Local Government Board upon these matters if they think it desirable to do so."

LECTURES ON THE SANITATION OF INDUSTRIES AND OCCUPATIONS.

WORKERS IN MERCURY, PHOSPHORUS, AND SULPHUR.

By T. EUSTACE HILL, M.B., C.M., B.Sc., &c.,

Medical Officer of Health for the County of Durham.

(Member.)

One of a course of five lectures on the Sanitation of Industries and Occupations.

Read November 15th, 1894.

I felt much honoured on being asked to deliver one of the lectures on the Sanitation of Industries which the Council of the Sanitary Institute, whose chief aim has always been the improvement of the Public Health and the advancement of sanitary science, has arranged during this month. The reduction in the general death-rate of this country, and consequently the diminution of sickness and suffering, which has rewarded the efforts that have been made for the better housing of the people and the improvement of the general condition of our towns and villages, has been so marked that popular interest in sanitation is now thoroughly aroused, and though I feel that the subject of to-night's lecture might have been entrusted to someone more able and experienced than myself, I have no doubt that the object of the Council of the Institute will be successful, and especially appreciated by sanitary inspectors, on whom recent legislation has transferred part of the work formerly performed by special factory inspectors.

The first part of my lecture has reference to the metal *mercury*, and to the health of those employed in industries where either the metal or its compounds is used. Mercury is not found either in the free state or in combination in this country, in fact, it is but rarely found in nature in an uncombined state, and then usually in the form of an amalgam with gold and silver. The sulphide of mercury (cinnabar), however, occurs in considerable quantities in Spain and elsewhere, and the metal can readily be extracted by simply roasting the ore, either alone

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or mixed with lime or iron filings, when metallic mercury is given off and is easily condensed. The preparation and purification of mercury on a commercial scale is entirely carried on abroad, the metal being imported into this country in an almost pure state. The processes usually employed appear to be very dangerous to the workers, who are said to suffer severely from mercurial poisoning.

Mercury has several properties which are peculiar to itself. It is the only metal which is liquid at all temperatures, but one of its chief characteristics, from an industrial point of view, is that it volatilizes or gives off vapours at ordinary temperatures which are readily absorbed by persons working in mercury, though they may not even handle the metal, and frequently give rise to mercurial poisoning. As an example of this, and as showing how readily mercury is absorbed into the human system, Dr. Taylor, in his excellent work on poisons, records an instance where a ship was laden with metallic mercury and during the voyage the bags in which the mercury was contained burst, so that the metal became scattered throughout the vessel, with the result that all the crew soon suffered from an aggravated form of mercurial poisoning.

Another peculiar property of mercury, and on which its application in several industries depends, is the readiness with which it forms alloys or amalgams with other metals. It is on account of this property that mercury is used in large quantities abroad for the extraction of gold and silver from their ores.

In this country the persons working in mercury or its compounds, and therefore exposed to the dangers of mercurial poisoning, are *water gilders*, *silverers or mirror makers*, *barometer makers*, *a class of bronzers*, *furriers and felt hat makers.*

In the process of *water gilding* the mercury is used for depositing gold on metallic surfaces. The metal to be gilt is first carefully cleansed, and then brushed over with a solution of nitrate of mercury, after which it is covered with a layer of the amalgam of gold and mercury. Heat is then applied to drive off the latter, and the gold is left deposited and only requires to be burnished. Throughout the process, both during the application of the amalgam, but especially during the driving off of the mercury, the workers are much exposed to the vapours of that metal. As far as possible the work is done in special chambers, from which the workman is separated by a glass sash, a small opening only being left at the bottom of the sash to allow of the hands being introduced for the necessary manipulation; but even with these and other precautions, the majority of those employed in the work are said to suffer sooner or later from mercurial poisoning to a greater or less

extent. Where large articles have to be gilt, the work cannot be done in glazed chambers, and is usually performed in the open shop, when the danger to the workmen is much increased. The process of water gilding has of late years very greatly been replaced by electroplating, though it is still considered preferable for gilding certain articles, such as sword handles, as there is an impression that mercurial gilding is more permanent than that deposited by the electrolytic process.

The silvering of mirrors, which was at one time the most important industry in which mercury was employed, is now fortunately very largely superseded by a much improved and harmless process by which metallic silver is deposited on the glass from a tartrate of the metal. The mercurial method of silvering is however still employed to some extent, especially for the production of articles sold at a low price, and is effected by carefully flattening out a sheet of tinfoil on the silvering stone and then covering it with mercury. The sheet of glass to be silvered is then slid over the tinfoil so that a portion of the mercury intervenes regularly between the tinfoil and the glass. The excess of mercury which is used in the process runs off the table into vessels suitably arranged, and is afterwards strained and made fit for further use. Dr. George Whitley, who in 1863 reported on the liability of workers in mercury to mercurial poisoning, stated that in the early days of the process mercurialism among the silverers was extremely common, but at the period of his enquiry, owing to the larger size of the workshops and their better ventilation, its prevalence had much decreased, though mild cases were even then by no means uncommon, especially among young men when first commencing to work at the process. Dr. Whitley also stated that silvering on a small scale was carried on in London by persons, chiefly Italians and Jews, at their own homes and that they probably suffered severely from exposure to mercury fumes, but I have not been able to ascertain whether the work is carried on under similar conditions at the present day.

Barometer and philosophical instrument makers appear to suffer very rarely from mercury poisoning. The work is generally carried on in well-ventilated shops, and the quantity of mercury dealt with is comparitively small. The chief danger arising from the work appears to be from the bursting of the tubes in which the metal is heated, but this is not of frequent occurrence, and the exposure to its vapour is even then not continuous. If the workmen are temperate and cleanly in their habits the liability to mercury poisoning in this particular industry is extremely small.

There is a form of *bronzing* by which a metallic appearance

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is given to plaster figures by rubbing them with an amalgam of mercury, tin, and bismuth and then varnishing them. Persons engaged in this work are said not uncommonly to suffer from mercurial poisoning in a marked degree.

Another class of operatives liable to mercury poisoning are felt-hat makers and skin and fur dressers. In this industry either acid nitrate of mercury or a mixture of that salt with the perchloride (corrosive sublimate) and arsenious acid is used. The hairy side of the skins is dressed with the mercury preparation and afterwards dried in heated rooms. The skins are then brushed and afterwards cut up by machinery and sorted, this latter part of the process being generally performed by women, who have to handle the furs constantly. The sorting of the furs is attended with the evolution of much dust, which contains particles of the dried mercury salt, and the danger to those inhaling it therefore cannot be overlooked, though at the present time there appears to be little evidence that cases of mercury poison among furriers and felt-hat makers are at all common.

A preparation of mercury is also used by taxidermists in preserving and stuffing the skins of animals. Artificial flower makers also employ to some extent the iodide, sulphide, and chromate of mercury as pigments, but no special inquiry appears to have been made as to whether they suffer to any extent in health as a result of using these substances. The number of persons employed in the trades I have mentioned where mercury in some form or other was used was never large, and owing to the fact that the two largest of them—water-gilding and silvering—have been for the most part superseded by improved processes, it has of late years considerably decreased; but among those still employed, cases of mercury poisoning appear to be not uncommon, and this is not to be wondered at when we consider that the metal gives off vapour at all ordinary temperatures; that both it and its compounds are easily absorbed into the system—through the unbroken skin as well as by the respiratory and alimentary tracts; that the absorption of very small quantities will frequently produce symptoms of mercurialism; that its elimination from the body is extremely slow; and that some individuals show a special susceptibility to its action.

The symptoms of mercury poisoning vary greatly, and I do not think it necessary to describe them minutely. All I need say is that among workers exposed to mercury the poisoning is usually of a more or less chronic form, and is evidenced as a rule by salivation or an increased flow of saliva, by sponginess of the gums, fœtor of the breath, and gastric and intestinal

derangements. At a later period the characteristic mercurial tremor (known as the "trembles") appears and affects the voluntary muscles, especially during movement or under emotion, but this tremor may be one of the first or almost the only symptom of chronic mercurial poisoning. If these symptoms be disregarded serious permanent injury may result, though a fatal termination of the illness is not common; and if the patient discontinues his employment before they have become marked, recovery generally takes place in a few weeks. Alcoholic intemperance both predisposes to and greatly aggravates the symptoms of mercurialism, while other predisposing causes are want of cleanliness, and an unusual susceptibility in some individuals, which may be due to an unusually slow process of elimination of the poison from the system.

Owing to the fact of mercury giving off vapours at all ordinary temperatures, and being so readily absorbed into the system, it is probable that whatever precautionary measures are adopted the workmen who are employed in such processes as water-gilding and silvering will occasionally suffer from mercurialism.

Free ventilation of the workshops is of course of great importance, and whenever possible the process should be carried on in chambers specially adapted for carrying away the mercury vapours from the workers. All mercury not in use should be kept in covered vessels, and the workers should handle the metal as little as possible. The floors of the workshops should be smooth and impervious and should slope towards gutters, so that any mercury that may be spilt can be easily collected. The workers should wear an outer dress of some washable material, well fitting at the neck and wrists, and the use of respirators is desirable, though experience has shown that it is almost impossible to get the workers to adopt this precaution. Cleanliness is most essential, and the face and hands should be frequently washed and the mouth rinsed, especially before meals, and no food should be allowed to be taken within the workshops. Temperance among the workers is also very important, and no person of known intemperate habits should be employed. Above all it is necessary that any worker showing the slightest symptom of mercurialism should be at once removed from his employment.

Passing on now to the consideration of *Phosphorus*, I come perhaps to the most important part of my lecture, for not only is its use essential in one very important industry—the manufacture of lucifer matches—but under certain conditions those exposed to phosphorus' vapours are liable to suffer from a peculiar but definite disease of a most serious nature.

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There are two varieties of phosphorus, the common or yellow phosphorus, and the red or amorphous phosphorus, and they differ greatly both in chemical and physical properties. Yellow phosphorus is a waxy, semi-transparent solid which gives off fumes at all temperatures above 32° F., and is luminous in the dark. It melts at a little above 110° F., and is extremely inflammable, taking fire in the air at a little above its melting point. It produces very severe burns if carelessly handled, and is a dangerous irritant poison.

Amorphous phosphorus on the other hand is usually met with as a dull red powder with a specific gravity somewhat higher than that of the yellow variety. It chiefly differs from the latter in that it is not poisonous, does not emit fumes, and is not inflammable till heated to a temperature of about 500° F. It can be handled with safety at all ordinary temperatures and its use is practically free from danger.

The manufacture of phosphorus in this countrv, is mainly carried on by one large firm at Oldbury, near Birmingham, which, I understand, are also the sole makers of amorphous phosphorus. Ordinary phosphorus is derived almost entirely from calcined bones which are composed chiefly of phosphate of lime. After calcination the bones are treated with somewhat diluted sulphuric acid, with the result that insoluble sulphate of lime is formed, and a superphosphate of lime is left in solution. After standing, the supernatant fluid is poured off, evaporated to the consistence of a syrup, then mixed with vegetable charcoal and evaporated to dryness. The dried compound is then strongly heated in earthenware vessels with the result that phosphorus distils over from the retorts and is received into metal pots filled with water where it condenses into cakes. It is then purified by simple means. The usual cylindrical form of pure phosphorus is given to it by melting it under water, by means of steam, in leaden vessels, from the bottom of which horizontal tubes of the required size pass into troughs of cold water. The melted phosphorus is forced by its own weight through the tubes, whose form it takes, and escapes at the distal extremeties, when it is cut up into sticks of the required length. In the early days of phosphorus making the stick form was given to it by workmen sucking it while in the melted condition into glass tubes, but this highly dangerous practice has long been abandoned.

Amorphous phosphorus is prepared by continuously heating the yellow variety in an enclosed iron cylinder at a temperature of from 400° to 500° F. for a month or six weeks. It is then ground under water, and dried at a moderate temperature on leaden slabs. The danger to the workers employed in the

manufacture of phosphorus appears to be very small. Phosphoretted hydrogen and other poisonous gases, with a little phosphorus itself, are given off during the application of intense heat in the last stage of the process; but all these vapours are conducted away from the workers, burnt, and rendered harmless. Most of the other stages of the manufacture are carried on under water, and therefore without danger. The number of persons engaged in the preparation of phosphorus is very small, probably not exceeding 100, and the majority of these are engaged in work, which, under no circumstances, exposes them to its vapours. Dr. Bristowe, who, thirty years ago, carefully inspected the largest phosphorus manufactory in the country, gave as his opinion that the dangers to the workers employed therein were extremely small.

As to the industries in which phosphorus is employed, by far the most important is that of lucifer and other kinds of match-making; in fact, nearly the whole of the phosphorus manufactured is employed for that purpose. Dr. Bristowe ascertained that in 1862 there were in England about fifty-seven match-making establishments employing between them over 2,500 persons, and though at the present time many of the smaller factories have ceased to exist; on the other hand, the out-put of the larger factories is very much larger than it was thirty years ago, and the number of persons to-day employed in the industry is much greater. As showing the importance of the match-making trade, I may state in 1886 the value of matches, produced by one of the largest factories in this country, was £500,000.

In addition to the safety matches, of which I shall speak later, there are several kinds of matches in which common phosphorus is employed, viz., the congreve or ordinary wooden matches, wax vestas, and vesuvians. Formerly fusees and silent matches were made in considerable quantity, but the demands for these died out, and they are hardly ever now made in this country.

The process of manufacture of all kinds of matches is practically the same, where common phosphorus is used, as regards danger to health, and I shall therefore confine myself to giving a short account of the manufacture of the ordinary lucifer matches, and to pointing out in which processes of the manufacture the danger to health from the use of phosphorus is greatest.

The factories in which lucifer matches are produced are usually divided into several departments, where different parts of the work are carried on. The making of the boxes for holding the matches and the cutting of the wooden splints are, as a

rule, carried on outside the works and need no consideration, though I may state that the splints are at first twice the length of the prepared matches, and at some period of the manufacture, before the application of the phosphorus composition, require to be cut in two—a process known as "cross-cutting."

The first operation in the preparation of the matches is the charring of the splints, which is done by laying the bundles on end upon a stove or other heated surface till the ends are slightly browned. The object of this process appears to be to allow of the proper adhesion of the sulphur to the ends of the matches, or their saturation by the paraffin or other inflammable substance which may be used instead of sulphur. After being charred the ends of the matches are dipped into melted sulphur, stearine or paraffin for the purpose of ensuring that the match shall take fire when the phosphorus composition is ignited. Formerly sulphur was almost exclusively used for this purpose, but the fact that irritating sulphurous acid fumes are given off when the matches are ignited has led to its being very largely superseded by stearine, paraffin or other oleaginous substances. Another disadvantage in the use of sulphur is that the sulphur dippers are apt to suffer much inconvenience from the irritating vapours given off from the heated sulphur. The next process consists in the application of the phosphorus composition to the ends of the matches. In the early days of the industry this was done by simply dipping the ends of the splints while still in bundles into the composition, and matches thus made were known as "bundle-dips," and were mostly silent matches. Of late years the matches chiefly made in this country are known as "frame-dips," and receive this name from the fact that the splints before the application of the phosphorus composition are cut to the required size of the match, and then fixed in frames or clamps in such a manner that the matches are separated from one another and their ends form a level surface on both sides of the frame. By this means the matches can be all equally tipped with the phosphorus composition.

This composition varies greatly, both as to the nature and proportion of its ingredients, but it consists essentially of phosphorus, chlorate of potash, and glue. Powdered glass is also frequently introduced, and sulphide of antimony and peroxide of manganese are sometimes employed, together with colouring matter, such as prussian blue or vermillion. The chlorate of potash and peroxide of manganese are oxidising agents and promote inflammability, and—what is of greater importance—permits of a much less proportion of phosphorus being used. The percentage of phosphorus used in the composition varies greatly in the different manufactories, and

though there is no reason why it should exceed 5 per cent., a much greater proportion is sometimes used, especially in foreign factories.

The quantity of chlorate of potash employed is usually in inverse proportion to the phosphorus. In the making of the "bundle-dips" and silent matches very little chlorate of potash was used, and the phosphorus was largely in excess, as is the case also at the present day with many of the cheaper foreign matches. It is easy to understand that the greater the proportion of phosphorus employed in the composition the greater the danger to the workmen of phosphorus poisoning. In the preparation of the composition great care has to be taken to avoid accidents. The glue is first melted in a steam bath, and the phosphorus then introduced and thoroughly incorporated. The colouring matter and powdered glass are then added, and finally the chlorate of potash, previously moistened, is introduced. If the chlorate is added in a dry state, or if the phosphorus is added to the chlorate instead of in the order I have described, severe explosions are likely to occur, which may seriously injure those engaged in the mixing. Care has also to be taken that the composition does not become too dry, or explosion may occur during manipulation.

The tipping of the matches with the composition is effected by spreading some of it evenly by means of a spatula on a smooth plate heated by steam and then placing the frame containing the splints horizontally on the plate so that the ends of the splints sink evenly into the composition. On removing the frame each match is tipped with a small button of the composition, which on drying evenly surrounds the end of the splint. The matches have now to be dried, and this is as a rule performed in specially warmed and fireproof rooms, where the frames containing the matches are placed on racks, though in summer they are sometimes dried in the open air.

In the process of drying a good deal of phosphorus vapour is given off, and it is therefore important in the interests of the workman that it should be effected in a room separate from the rest of the manufactory. The last stage in the manufacture is that of boxing, or the removing of the dried matches from the frames and filling them into boxes ready for sale. During this process it is not uncommon for the matches to catch fire, when they are extinguished by pressing them into damp cloths.

Of late years matches known as "safety matches" have come greatly into use in this country, and are manufactured largely by several London firms and also in enormous quantities in Sweden. In these matches the use of ordinary phosphorus is

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entirely dispensed with, and they are not spontaneously combustible, so that the dangers inseparable from the production of ordinary phosphorus matches and from their ready inflammability are almost entirely removed. The mixture with which these safety matches are tipped consists chiefly of chlorate of potash and glue, with varying proportions of sulphide of antimony, peroxide of manganese and powdered glass. For the ignition of these matches they require to be rubbed on a portion of the box which has been covered with a paste, the chief ingredient of which is the harmless amorphous phosphorus. Unfortunately these matches as made in England are slightly more expensive than the ordinary matches and are not quite so convenient, and for these reasons they have not supplanted the common lucifer to the extent that might have been anticipated from the obvious advantages they possess. Safety matches have also been made in which amorphous phosphorus is contained in the heads of the matches, but there appear to be serious difficulties in their manufacture which up to the present have prevented them coming into general use.

In the production of lucifer matches the persons who have to do with phosphorus, and who are, therefore, liable to exposure to its vapour are especially those engaged in making the composition, and in applying it to the ends of the matches. Both in the "mixing" and the "dipping," as these processes are called, and in the drying of the matches, phosphorus fumes are largely given off and the workers who perform this part of the industry are especially exposed to the dangers of phosphorus poisoning. Phosphorus is also given off from the dried matches, and those occupied as frame emptiers and box fillers are therefore to some extent exposed to its vapours. On the other hand the frame fillers, who form a considerable proportion of those engaged in match manufactories, need in no way be exposed to the fumes of phosphorus, though formerly it was not uncommon for the frame fillers to work in rooms where phosphorus was employed and therefore to be exposed to its effect. The amount of phosphorus vapour given off in the various stages of the manufacture depends greatly on the quantity employed in the composition, being much more abundant where the proportion of phosphorus used is large, and then the liability of the workers to phosphorus poisoning is much increased.

In the manufacture of safety matches no vapours of phosphorus are given off in any stage of the manufacture.

Phosphorus is also used in the preparation of certain vermin pastes, but not to any large extent, and its proportion in these preparations is usually under 5 per cent.

During the last few years phosphorus has been also somewhat

largely employed in the manufacture of phosphor bronze. The trade however is, I believe, a very limited one, and the phosphorus used in the process is dealt with by some responsible person. There appears to be no special diffusion of phosphorus vapour, and neither in this trade nor in the preparation of phosphor vermin pastes is there any evidence to show that the workers suffer from exposure to the fumes of phosphorus.

As to the liability of workers in *phosphorus* to poisoning by that substance,—it was noted as far back as the year 1845 that those employed in the manufacture of matches in Germany and Austria were apt to suffer from a disease of the jaw, which proceeded to the necrosis or death of the bone and frequently ended fatally. Though this disease did not appear to be so prevalent in this country, cases were reported from time to time, and as a result of his enquiries in 1862 Dr. Bristowe ascertained that there had been at least fifty-nine cases of this jaw disease in England. The persons affected were as a rule those who had been for some years much exposed to the vapours of phosphorus, as dippers or mixers. The disease was entirely confined to the bones of the jaw, the lower jaw being most frequently affected, though in several instances both jaws were attacked. The first symptoms were usually those of toothache, which was not relieved by extraction of the tooth, but was followed by ulceration and destruction of the subjacent bone till at length the whole jaw might be destroyed. The duration of the disease varied. In some instances where destruction of the bone was but slight, recovery took place in a few months, but this was often delayed for years, and in many instances death resulted from exhaustion or from some wasting disease, such as phthisis. While the exciting cause of the disease is undoubtedly the exposure to phosphorus' vapours, the predisposing cause appears chiefly to be some unhealthy condition of the gums or teeth, and most authorities are agreed that the disease mostly occurs in workers whose teeth are decayed. That the prevalence of the disease was also greatly dependent on the conditions under which those engaged in the match industry worked, is shown by the fact that in the large well-ventilated and well-arranged factories cases of jaw disease are extremely rare, while in those factories which were formerly badly ventilated and where the processes of mixing, dipping, and drying were carried on in the same room that the workers engaged in frame filling, boxing, &c., were employed, phosphorus poisoning was by no means uncommon. Dr. Bristowe gives an excellent example of the effect of the conditions of employment on the health of those engaged in the manufacture of matches, and I cannot do better than quote from his report.

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He says:—“By far the most remarkable and instructive
“experience of the disease, however, is that afforded by a
“congreve manufactory in Manchester, which is one of the
“largest in England, and in which 250 persons, exclusive of
“box makers and splint cutters, are constantly employed in the
“various processes of match making. This factory has been in
“existence for about twenty-five years, and during the first
“twenty years of its operations, no less than twenty-four cases
“of jaw disease occurred. The disease, too, in this case was not
“limited, as in most other factories, to the dippers and mixers,
“and consequently to adults, but the boxers, the cross cutters,
“and the pickers out, formed a large proportion of those affected,
“and children from twelve to fifteen years of age suffered as
“well as their elders. The explanation, however, is easy, and
“was pointed out to me with great candour by one of the pro-
“prietors. The fact is that all those various conditions which
“tend to the production of the disease were here concentrated
“and combined, and all the operatives became nearly equally
“exposed to the fumes of phosphorus. A very large number
“of workpeople was employed; they were confined in low, ill-
“ventilated, overcrowded rooms; the dipping, the drying, the
“boxing, &c., were all carried on in the same apartment;
“bundle-dips formed a large proportion of the matches which
“were manufactured; and the composition employed contained
“one-third of phosphorus. Further, at one period (and about
“that time the disease was most prevalent) the operatives
“worked far into the night as well as by day. About five
“years ago the proprietors, who had been much concerned by
“the frequent occurrence of the disease, set to work seriously
“to remedy the defects on which they believed it to depend.
“They constructed large, airy, well-ventilated rooms; they
“gave up the manufacture of bundle-dips; and they diminished
“by one-half the strength of the composition. The result has
“been that not a single case of the disease has originated in
“the factory during the five years that have elapsed since the
“above improvements were effected.”

Excepting for the jaw disease, there appears to be no form of sickness to which workers in phosphorus are specially liable, though those who have been long employed in the manufacture of matches are said to often look sallow and unhealthy, and to be liable to gastric derangements. In the manufacture of phosphorus itself, and in the preparation of vermin pastes and phosphor-bronze, the workmen appear to suffer no ill-effects, and I am not aware that a case of jaw disease has ever occurred among those employed in these industries.

Of the precautionary measures to be taken to obviate the

dangers arising from the vapours of phosphorus to those engaged in the manufacture of matches, the most important is undoubtedly the substitution of amorphous for common phosphorus; and there is no practical difficulty to prevent this being carried out, the only objection to safety matches being that they are not so convenient, as they will only as a rule ignite when rubbed on a prepared surface and that they are slightly more expensive than the common lucifer. In fact, for nearly twenty years the use of matches containing ordinary phosphorus has been prohibited in Denmark and Switzerland, and only safety matches are allowed to be used in these countries. Experience has shown, however, that with proper precautions the dangers arising from the use of common phosphorus can be very greatly minimised, if not altogether prevented. For this purpose:—

1. The proportion of phosphorus in the composition should be as small as possible, and there is no reason why it should exceed five per cent.

2. The workmen engaged in the processes of mixing and dipping should occupy well-ventilated rooms, separate from the other operatives, and, as far as possible, their work should be carried on under specially ventilated hoods.

3. The workshops in which the frame emptiers, box fillers, and others are employed should also be large and well ventilated, and the frame fillers should, if possible, occupy a separate room so that they may in no way be exposed to the phosphorus fumes.

4. The matches should be dried in special fire-proof rooms, and all persons entering them should be required to wear respirators.

5. Persons suffering from bad teeth or from any inflammatory affection of the gums, should be debarred from working in any of the departments of a match factory where phosphorus is employed.

6. Personal cleanliness among the workers is of the greatest importance, and the hands should be washed before taking food, which should not be taken in any part of the factory where the fumes of phosphorus are evolved.

7. Owing to the fact that turpentine retards the oxidation of phosphorus, its use has been advocated in rooms where phosphorus is employed, and in some factories the workers carry flasks, or sponges containing turpentine, on their chests, so that they may breathe air impregnated with it. It is doubtful, though, if this precaution is of much value though the workpeople generally believe in its efficacy.

It is satisfactory to know that most of the above precautionary

measures have been adopted by the leading match manufacturers in this country, and as a result cases of phosphorus necrosis or jaw disease are now of very rare occurrence.

Owing to its inflammability, the careless handling of phosphorus may produce severe burns which are extremely painful and very slow of healing; while, as I have previously stated, want of care in the making of the phosphorus composition may cause serious explosions and danger to the workers. Such accidents, however, are not common, but the fact that they may occur furnishes another argument in favour of the use of amorphous phosphorus.

Before leaving this part of my subject, I should like to mention an incident of which I was a witness and which demonstrates that even the use of safety matches may not be free from danger. I was one day travelling in a railway carriage, when I noticed that the coat of a gentleman sitting opposite to me was slowly burning. The fire was quickly extinguished and at the time was attributed to some loose matches in his pocket having accidentally been set on fire. A short time afterwards, however, I was again travelling with this gentleman when a repetition of the accident occurred, and as he was this time wearing an overcoat, his garments where badly burnt before the accident was discovered. On carefully examining the contents of his pockets this apparently extraordinary accident was easily explained, for in the pocket where the fire originated were found a box of safety matches and some loose chlorate of potash lozenges which the gentleman was in the habit of carrying with him for a relaxed throat from which he suffered. The accidental friction of the lozenges against the prepared surface of the box containing amorphous phosphorus had undoubtedly caused ignition, the chlorate of potash lozenge being composed largely of the chief ingredient contained in the head of a safety match.

Sulphur (and under this heading I shall include those compounds of sulphur which are of industrial interest) is the last subject I have to deal with. Sulphur does not occur in this country in a free state, though as a sulphide in combination with iron and copper (pyrites) and lead (galena) it is by no means uncommon. Most of the sulphur used in this country is, however, imported from Sicily, where, as also in other volcanic districts, it is found in a native condition and only requires to be purified from the earthy matters with which it is always to some extent associated.

Of late years sulphur has been extracted on a large scale in this country from the tank waste produced in the manufacture of alkali. The process is known as the Sulphur Recovery

Process, of which I shall speak later, and at one large alkali works on the Tyne over 200 tons of pure sulphur are produced weekly.

Sulphur in its ordinary form is, as you all know, a yellow, brittle solid which possesses very little taste or smell and is insoluble in water. It melts at a comparatively low temperature (115° C) and is combustible, burning with a blue flame and forming sulphur dioxide gas. From an industrial point of view sulphur itself is not of much importance, and the dangers to those working in it are not great. It is chiefly employed in the manufacture of gunpowder, in the vulcanization of india-rubber, in the manufacture of matches, and for the production of sulphur dioxide gas.

Sulphur grinders and those working in powdered sulphur sometimes suffer from redness and irritation of the skin, which causes considerable inconvenience and irritation; while inflammation of the eyes is not uncommon. Other symptoms as a result of the entrance of the sulphur dust into the alimentary canal are loss of appetite and looseness of the bowels, and, as might be expected, persons who have worked for a long time as sulphur grinders are somewhat liable to bronchitis as a result of the irritation of the respiratory mucous membrane by the sulphur dust.

In match manufactories melted sulphur is sometimes used for tipping matches, and those engaged in this process often suffer considerably from irritation of the eyes and the respiratory tract owing to the evolution of sulphur dioxide. The shorter the hours of labour the less likely are sulphur workers to suffer from their employment, while other precautionary measures to be observed are frequent cleansing of the skin and the covering up, as far as possible, of the nose and mouth.

There are, however, several compounds of sulphur which are important in their industrial application, and the chief of these is *sulphur dioxide*, which is easily obtained by burning sulphur or calcining the metallic sulphides in the presence of air. This compound (sulphur dioxide) is a colourless gas and is very soluble in water, in combination with which it forms sulphurous acid. In its pure state it is quite irrespirable, and even greatly diluted causes much irritation to the respiratory passages; it is highly destructive of all forms of animal life, and is therefore used largely as a germicide and disinfectant, and it is possessed of strong bleaching properties. Sulphur dioxide is employed or produced in a number of industries to a greater or less extent.

In the manufacture of sulphuric acid it is produced in enormous quantities by burning pyrites in large furnaces, from which

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it passes into leaden chambers, where it comes in contact with nitro-oxygen vapours and steam, with the result that sulphuric acid is formed. The furnaces and other apparatus employed in the manufacture of sulphuric acid are however so well contrived that the process appears to cause but little danger to the health of the workmen, though in most of the factories the odour of sulphur dioxide is distinctly perceptible. Several accidents have, however, occurred to the workmen employed to clean out the furnaces in which the pyrites is burnt, owing to their entering the chambers before the sulphur dioxide has entirely escaped, but such mishaps are the result of recklessness on the part of the workmen and not of any defect in the process of manufacture.

But if we except the manufacture of sulphuric acid, the chief application of sulphur dioxide is as a bleaching agent, and it is especially useful in the bleaching of woollen, silk, and straw goods. In the bleaching of straw it is necessary that the articles be turned or changed from time to time, and for this purpose it is usual for a workman to enter the bleaching chamber, to do which he has to hold his breath for one or two minutes. This practice is undoubtedly a dangerous one, and those engaged in it usually suffer to some extent from the effect of the gas.

Sulphur dioxide is also useful as a preservative, and for this purpose is somewhat largely used in the preparation of hops. The chief danger to those engaged in occupations in which sulphur dioxide is employed arises from the irritating and suffocative properties of the gas. Those much exposed to it are apt to suffer from dryness of the throat, difficulty of breathing, and spasmodic cough, while loss of appetite and intestinal derangements are also stated to result from such exposure. Sulphur dioxide is also largely evolved in the roasting of pyrites for the extraction of the copper, and along with other gases in the manufacture of alkali by the Leblanc process, and in cement and coke making, brick-making, &c.

Another compound of sulphur of some industrial interest is *sulphuretted hydrogen*, a compound of sulphur and hydrogen. It is a gas which has a most offensive odour of rotten eggs, is combustible, burning with a pale blue flame, and is soluble in water, to which it imparts its disgusting odour. This gas is frequently given off in considerable quantity in the neighbourhood of alkali works from the "tank waste" or waste heaps, which consist largely of a sulphide of lime. In a pure state sulphuretted hydrogen is highly poisonous, and even when extremely diluted appears to have a serious effect on the health of those exposed to it, if we accept the opinion of

Dr. McNicoll, the Medical Officer of Health of St. Helens. In that town, where much sulphuretted hydrogen is given off from the waste heaps of numerous alkali works, Dr. McNicoll has stated that the diffusion of that gas in the atmosphere increases the amount of sickness, greatly increases the infant mortality, and is the cause of many epidemics of infectious disease assuming a malignant type. In South Shields and Jarrow, where the air was frequently polluted by the large quantity of this gas given off in the neighbourhood of alkali works, both my own experience as Medical Officer of Health and that of my predecessor, Mr. Spear, confirmed to some extent the opinion of Dr. McNicoll that the presence of even a small quantity of this gas had a lowering effect on the health of those breathing it, and was apt to cause malaise, general depression, and even sickness.

Of late years means have been devised for the recovery of the sulphur contained in the heaps of tank waste produced at chemical works. The process is known as the "Sulphur Recovery Process," and it is carried out on a very large scale at a few manufactories in this country. Stated shortly, the process consists in intimately mixing with water the powdered tank waste, which, as I have already mentioned, consists chiefly of a sulphide of lime. This mixture, which is known as "slurry," is then conducted to a series of large iron tanks connected with one another, and carbonic acid gas is forced through it, with the result that sulphuretted hydrogen is liberated, and ultimately collected in large gasometers. The sulphuretted hydrogen gas is then mixed with air, and passed into large heated chambers through a layer of oxide of iron contained therein, when further decomposition takes place and sulphur is produced. A little sulphuretted hydrogen escapes decomposition, and together with some sulphur dioxide gas which is produced are passed through a furnace to render them harmless before being discharged into the air.

I recently visited a large alkali works where 4,000,000 cubic feet of sulphuretted hydrogen gas are produced every day by this process. Every precaution is taken to prevent the escape of this gas, but nevertheless on the day of my visit the chamber where the slurry is decomposed by carbonic acid gas, smelt strongly of sulphuretted hydrogen in some parts, and though only breathing it for a short time I suffered afterwards from marked depression and cardiac weakness. I was told that the escape of gas on the occasion of my visit was quite unusual, and the workmen employed in this part of the works certainly appeared to suffer no ill effects. The length of time this process has been in operation is, however, too short to judge of

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its effect on the health of those employed in it, but unless the strictest precautions are taken to prevent the escape of sulphuretted hydrogen I am convinced that the health of the worker must in time be seriously affected.

The only other compound of sulphur of industrial importance is *bisulphide of carbon*, which is employed in india rubber manufactories in the vulcanization of the rubber. It is a very inflammable and highly refractive liquid, which at all temperatures gives off a very poisonous vapour, which is also as a rule most offensive. M. Delpech, thirty years ago, pointed out its serious effects on the health of workpeople employed in the small and often insanitary india rubber works which then existed in the neighbourhood of Paris, and although the manufacture of rubber in this country is conducted in spacious, well-ventilated factories, and the use of bisulphide of carbon has been much curtailed, still it must not be lost sight of that unless proper care is exercised the health of those who have to deal with this substance may be seriously affected. Instances of poisoning by carbon bisulphide in this country appear, however, to be of very rare occurrence, though cases have been recorded. Bisulphide of carbon is also employed at a factory near Bradford for the recovery of the grease from the soapsuds resulting from the washing of wool; but here also, owing to the precautions taken, there appears to be no evidence of injury to the health of those employed. To diminish the dangers to the workers from these compounds of sulphur to which I have referred, it is necessary that the work should be carried on in spacious, well-ventilated factories, and that special means should be adopted as far as possible to carry off from the workman and to destroy the poisonous vapours.

In the manufacture of sulphuric acid and in the bleaching processes the plant should be as perfect as possible to prevent the unnecessary escape of the sulphur dioxide gas, and the same remark applies to the use of sulphuretted hydrogen in the sulphur recovery process. In the processes where sulphur dioxide is used, absorbents such as moist sawdust or milk of lime, may with advantage be employed in the factory. It is difficult to prevent the escape of sulphuretted hydrogen from the huge heaps of tank waste of the alkali works, but by proper drainage of the heaps, and as a result of the gradual oxidation of the portion exposed to the air, the nuisances from the old heaps are now much diminished, and owing to a great change in the process of alkali manufacture and to the fact that the sulphur can now be recovered from the tank waste, these heaps are now no longer deposited to any extent.

I think you will have gathered to-night that while in the

early days of the industries in which mercury and phosphorus were employed, the dangers to the health of the workers from the vapours given off by these substances were very great, fortunately at the present day, owing to the adoption of improved processes and the administratien of the Factory and Workshops Acts, together with the exercise of greater care both by the employers and workers, the dangers resulting from these occupations have been very greatly reduced; but in all industries where injurious vapours or dust are evolved, a great deal depends on the attention to personal cleanliness and the adoption of reasonable care by the workers themselves, who above all others should also be temperate and regular in their habits. Otherwise injury to health will from time to time occur, however well adapted the factories may be, and whatever legal enactments are in force

CHLORINE AND CHROME COMPOUNDS.

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One of a course of five lectures on the Sanitation of Industries and Occupations.

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MY subject is of a two-fold character, and deals with two important compounds used in the chemical industry—Chlorine and Chrome.

THE MANUFACTURE OF BLEACHING POWDER.

This department is undoubtedly by far the most trying of all to those employed in chemical works, owing to the exposure to chlorine gas, under the system which generally prevails at present. In the "Weldon" chambers, which are most commonly used, a thick layer of lime, 4 to 6 inches, is spread on the floor. The chambers are then closed, and strong chlorine gas is turned on, which is absorbed by the lime. At the end of about four days the gas is turned off, the free gas in the chamber is either drawn off by an exhaust, or absorbed by a lime distributor, and the doors are opened. The men, about two hours afterwards, enter to pack the powder. As soon as the powder is disturbed by the shovel it gives off chlorine gas, and no man could work in the chamber without some form of respirator. The packers, in order to be able to work in the chambers, wear a respirator, commonly called a "muzzle." This consists of about thirty folds of flannel, damped and tied tightly over the mouth, with the nostrils free, and resting on it. The men are obliged to inhale through the muzzle, and exhale by means of the nostrils, otherwise they would be "gassed." The exertion of breathing through the thick folds of flannel shows itself by the red and puffed state of the men's faces, and profuse perspiration on coming out of the chambers, which they are obliged to do at intervals during their work. Some, but by no means all, wear "goggles" to save the eyes from the lime dust. None but strong healthy men could stand the work. Those liable to bronchitis would quickly feel the effects of the gas, which has a tendency to produce bronchial inflammation. In another process of making bleaching powder, the "Deacon" chambers are used.

In these chambers the lime is put in thin layers on a series of trays, one above the other; the chambers are closed, and dilute chlorine gas, containing only about 5 per cent. of chlorine, is turned on. When the chambers are opened the packers work from the outside, and the bleaching powder falls through a hopper into barrels below. Though exposed to some gas, the packers at the Deacon chambers can use a very much smaller "muzzle," which is therefore not nearly so trying. In addition to these, mechanical means have been tried for the manufacture of bleaching powder which would obviate all exposure to the gas. The Hasanclever process, by mechanical means, is said to be now successfully used in Germany. Messrs. Brunner, Mond & Co. have a somewhat similar plant of their own for the manufacture of bleaching powder, and there is a patent automatic continuous producing-chamber, invented by Messrs. J. M. and A. Milnes. I strongly contend that the old process should be abolished and some mechanical process adopted. Until this is done certain special rules have been suggested to obviate, in some degree, the escape of gas for the benefit of those working in and around the chambers.

The packers themselves do not as a rule complain, although some of them have been employed in this occupation for many years, being tempted no doubt by the short hours and high rate of pay. But complaints are made by those whose work takes them near the chambers; many of these complain of the effects of the chlorine gas on their health.

Salt Cake (Sulphate of Soda) Department.

In this department those employed are more or less exposed to the escape of hydrochloric acid gas. Many of the men have had their teeth entirely destroyed by its effects, but this seems attributable to the use of a rag or "bite" between the teeth. The hours of work in this department are long, consisting of two shifts of thirteen hours each. I am convinced that with increased care a great deal of the escape of gas might be prevented.

Vitriol Department.

The hours in this department are very long, amounting to an attendance of eighty-four hours per week, though the actual work is not continuous. If the plant is bad, either chambers, towers or pipes, those employed may be exposed to sulphurous and nitrous fumes, but with care and due observance of rules laid down under the Alkali Act these should be prevented.

Caustic Soda Department.

In this department those employed are not subject to fumes or gas, but danger arises from splashing of the liquor and from the construction of the caustic pots themselves. Special rules have been proposed as to the construction of the pots, and the supplying of syringes for treating injuries to the eyes.

Chlorate Department.

The danger here is from explosion or from clothing becoming impregnated with chlorate dust and catching fire. The use of overalls is recommended in the grinding rooms, the use of some such lubricant as tallow instead of oil, ventilating cowls in the roof, electric lighting where practicable, and baths kept ready for use.

Black Ash Department.

The danger here is from the unfenced gangways across the vats. The vats should either be covered or the gangways fenced.

Hours of Labour.

In some departments of alkali works very long hours of labour prevail.

In the vitriol department these amount, for burner men, to an actual average attendance at the works of 84 hours per week, whilst in the salt cake departments the men are accustomed to work two shifts of thirteen and eleven hours respectively. The adoption of eight-hour shifts is very desirable, and this has already been successfully tried in some departments at some of the works of the United Alkali Co., whilst at the works of Messrs. Brunner, Mond and Co. eight-hour shifts prevail throughout. At Messrs. Brunner, Mond and Co.'s the improvement of the men's health since the eight-hour shifts were adopted is very encouraging. The figures connected with their sick club, show that during a summer quarter in 1889, before the introduction of three shifts, the percentage of those who received sick pay was 7·1, whilst during the same quarter of 1893, after the introduction, the percentage was only 5·1, or a reduction of 28·3. In 1889 the men attended by the doctor equalled 10·1 per cent., but in 1893 only 5·1 per cent., or a reduction of 49·6. Messrs. Brunner, Mond and Co. point out the great reduction in those who received the doctor's attendance, which means stopping away from work one or two days without

actually being laid up for a week, as in their club only men absent for a week receive sick pay.

Messrs. Brunner, Mond and Co. state that the cost of wages paid per ton of alkali produced by them is now no more than it was some years ago, in spite of the fact that the men employed on shift work are paid the same wages for eight hours as they were formerly paid for twelve. This improvement they attribute partly to improvements in the apparatus used, effected at considerable cost, and partly to the increased efficiency of the men due to their better health and spirits.

The Effects upon the Workers.

The men employed in the manufacture of bleaching powder are exposed to the following evils, viz.:—

The inhalation of—

(1.) Chlorine gas.

(2.) Chloride of lime in the form of dust (bleaching powder).

The effects may be the following—

(1.) Irritation of the lining membrane of the windpipe and bronchial tubes, leading to bronchitis and asthma (or both combined), accompanied by severe cough and profuse expectoration.

(2.) The prolonged irritation may give rise to disease of the lung substance, running on in some cases to a form of consumption.

(3.) Inflammation of the superficial membrane of the eyes (conjunctivitis).

With a view of lessening the foregoing ill effects I would suggest—

(1.) Free and thorough ventilation in and about the bleach chambers.

(2.) Oiling or greasing of the exposed parts of the body before commencing work, the wearing of "goggles," and the introduction at intervals of a few drops of castor oil into the eyes for their protection.

(3.) Having made various experiments with different chemicals in the hope of increasing the efficiency of the so-called "muzzles," or respirators now in use, I would suggest the following method:—

Let the respirators be moistened from time to time with a solution of sulphite of soda. The chlorine gas coming in contact with the sulphite of soda, the latter is converted into sulphate of soda, while the chlorine

now appears as hydrochloric acid. The latter, being readily absorbed by water, is held by the moist respirator, whereas chlorine gas, which is only sparingly soluble in water, passes to a considerable extent through the respirators as at present used.

Were this suggestion carried out, the respirator or "muzzle" might be made much thinner than at present. In this way the heat would be lessened, and the men would be able to breathe with greater freedom and safety.

Special Rules.

I. In future every uncovered pot, pan, or other structure containing liquid of a dangerous character, should be so constructed as to be at least three feet in height above the ground or platform. Those already in existence which are less than three feet in height, or in cases where it is proved to the satisfaction of an Inspector that a height of three feet is impracticable, should be securely fenced.

II. There should be a clear space round such pots, pans, or other structures, or where any junction exists a barrier should be so placed as to prevent passage.

III. Caustic pots should be of such construction that there shall be no footing on the top or sides of the brickwork, and dome-shaped lids should be used where possible.

IV. No unfenced planks or gangways should be placed across pots, pans, or other structures containing liquid of a dangerous character. This rule should not apply to black ash vats where the vats themselves are otherwise securely fenced.

V. Suitable respirators should be provided for the use of the workers in places where poisonous gases or injurious dust may be inhaled.

VI. The lighting of all dangerous places should be made thoroughly efficient.

VII. Every place where caustic soda or caustic potash is manufactured should be supplied with syringes or wash bottles, which should be enclosed in covered boxes fixed in convenient places, in the proportion of one to every four caustic pots. They should be of suitable form and size, and be kept full of clean water. Similar appliances should be provided wherever, in the opinion of an Inspector, they may be desirable.

VIII. Overalls, kept in a cleanly state, should be provided for all workers in any room where chlorate of potash or other chlorate is ground. In every such room a bath should be kept ready for immediate use.

In every chlorate mill, tallow or other solid lubricant should be used instead of oil.

IX. Respirators charged with moist oxide of iron or other suitable substance, should be kept in accessible places, ready for use in cases of emergency arising from sulphuretted hydrogen or other poisonous gases.

X. In salt cake departments suitable measures should be adopted by maintaining a proper draught, and by other means, to obviate the escape of low-level gases.

XI. Bleaching powder chambers, after the free gas has, as far as practicable, been drawn off or absorbed by fresh lime, should, before being opened, be tested by the standard recognised under the Alkali Act. Such tests should be duly entered in a register kept for that purpose, which should be produced to an Inspector whenever called for.

All chambers should be ventilated, as far as possible, when packing is being carried on, by means of open doors on opposite sides and openings in the roof so as to allow a free current of air.

XII. In cases where the co-operation of the workers is required for carrying out these rules, and where such co-operation is not given, the workers should be held liable in accordance with the Factory and Workshops Act, 1891, section 9, which runs as follows:—"If any person who is bound to observe any special rules established for any factory or workshop under this Act acts in contravention of, or fails to comply with, any such special rule, he shall be liable on summary conviction to a fine not exceeding two pounds."

Bichromate of Potash or Soda.

This manufacture is practically in the hands of three firms at Glasgow, Rutherglen, and Falkirk.

Almost all the men working where dust is prevalent, more especially between the furnaces and the dissolving tanks, have either perforation of the septum of the nose, or have lost the septum altogether.

Many of those employed suffer also from what are technically called "Chrome holes" on hands and arms. These are caused by dust or liquor acting on broken skin, or by the handling of crystals.

Process of Manufacture.

Chrome ore is ground by machinery. A great deal of dust prevails in the grinding rooms, and the use of some form of

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respirator is advisable, though this dust is only harmful mechanically.

The ground ore is put into hot furnaces with carbonate of potash, or soda, and lime, and comes out in the form of cake. This cake is often placed on the floor and allowed to cool before being put into the tanks. When cool, a great deal of deleterious dust arises from throwing it into the tanks. This harmful dust might to a great extent be obviated by throwing the cake into the tanks at once, instead of leaving it to cool and form dust.

The cake when placed in the tanks is treated with water and the chromate of soda or potash dissolved out. The solution of yellow chromate is then treated with sulphuric acid, and bichromate is thus formed. This solution is evaporated, and the crystals are obtained.

I strongly recommend the use of respirators where any dust arises, and the use of gloves where crystals have to be handled. Sufficient suitable lavatory accommodation and appliances should also be provided.

The due observance of cleanliness on the part of the operatives would largely conduce to the prevention of the evils referred to.

Chemical Works in General.

As regards the question as to how far the injurious effects depend upon the age and sex of the operatives, it may be remarked that no females are employed in alkali works, and but few boys under 18 years of age, except in cooperages, plumbers' shops, box-making, &c. I do not suppose that exceptional mortality, apart from accidents, exists in them.

Effects upon Workers in Chrome Compounds.

The evil effects upon these workers are due to chromic acid combined either with potash, soda, or lime. The lining membrane of the nostrils almost invariably suffers. Irritation of the membrane is followed by ulceration, leading ultimately to perforation, or complete destruction of the nasal septum.

These results cause, in many cases, partial or complete loss of the sense of smell. Similar irritation and ulceration take place in the throat, windpipe, and bronchial tubes.

The foregoing conditions are due to the inhalation of the corrosive dust, which is freely given off in various stages of the manufacture of chrome compounds.

Another effect is the production of ulcers, termed "chrome

holes," in various parts of the body, due to the deposit of chrome dust. These ulcers are remarkable for their depth, and for their slowness in healing.

After experimenting with various chemicals, with the view of lessening the evils caused by the inhalation of chrome dust, I would suggest the adoption of the following method. Let the sponge, or other absorbent material of the respirator, be moistened with a solution of bismuth (such as the liquor bismuthi of the British Pharmacopœia). The chrome dust coming in contact with this is decomposed, an insoluble compound of bismuth and chromic acid being formed.

The same result might be obtained, as far as the nose is concerned, by plugging the nostrils with cotton wool, previously soaked in the bismuth solution.

It may here be mentioned that solutions of bismuth, far from being irritating, have a decidedly soothing effect.

The cleansing of the exposed parts of the body by frequent ablution, and the protection of the hands by waterproof gloves in those who manipulate the chrome products, afford the best means of preventing the evil effects which I have described. Lavatories should be freely accessible to the operatives in all such works.

Sulphuretted Hydrogen Gas.

As workers are occasionally suddenly overpowered by breathing this gas, a speedy rescue is imperative. For this purpose a fellow workman, attempting the rescue, should use a respirator charged with moist oxide of iron. In order to restore consciousness, a supply of oxygen gas in a compressed form should be at hand. This is referred to in Rule IX., given on p. 86.

Special Rules for Bichromate Works.

I. In future every uncovered pot, pan, or other structure containing liquid of a dangerous character, shall be so constructed as to be at least three feet in height above the ground or platform. Those already in existence, which are less than three feet in height, or in cases where it is proved to the satisfaction of an Inspector that a height of three feet is impracticable, shall be securely fenced.

II. There shall be a clear space round such pots, pans, or other structures, or where any junction exists a barrier shall be so placed as to prevent passage.

III. No unfenced planks or gangways shall be placed across pots, pans, or other structures containing liquid of a dangerous character.

IV. Respirators suitable for protection of nostrils and mouth shall be provided where injurious dust or noxious fumes may be inhaled.

V. The lighting of all dangerous places should be made thoroughly efficient.

VI. Inasmuch as dust is the principal cause of the various evil results to workers in chromium compounds, all due means should be taken to limit in every way the formation of dust.

VII. Gloves of some waterproof material should be provided for the use of workers who handle the crystals.

VIII. Sufficient lavatory accommodation, with hot and cold water, soap, nail brushes, and towels, should be provided.

IX. In cases where the co-operation of the workers is required for carrying out the foregoing rules, and where such co-operation is not given, the workers shall be held liable in accordance with the Factory and Workshops Act, 1891, section 9, which runs as follows:—"If any person who is bound to observe any special rules established for any factory or workshop under this Act, acts in contravention of, or fails to comply with, any such special rule, he shall be liable on summary conviction to a fine not exceeding two pounds."

It will be noticed that many of these rules are similar to those for workers in chlorine compounds, but it has been thought well to quote them in full.

WORKERS IN COPPER, ZINC, BRASS & TIN.

By ROBERT M. SIMON, M.D.Cantab.,

Physician to the General Hospital, Birmingham.

One of a course of five lectures on the Sanitation of Industries and Occupations.

Read November 29th, 1894.

When your Council did me the honour to invite me to lecture to you on the use of tin, zinc, copper, and brass in manufacturing processes, and the dangers to which those working in these metals were subjected, I very naturally began to consider how I might hope to make the subject interesting to an audience like the present.

It was very easy to understand that those whose business in life it would be to act as Inspectors of factories should wish to know from what points of view these manufacturing processes ought to be regarded, in so far as they might influence the health and well-being of large numbers of working men, and through them the health and physical perfection of the next and succeeding generations. You are probably aware that lead workers, as a class, are not the parents of vigorous children, and that women who work in lead are not unfrequently sterile.

No doubt these facts are due largely to the particular poison to which lead workers are exposed, but in great part also to the general deterioration in health and physique to which all those who are employed in unhealthy trades are liable.

A trade may be unhealthy, or regarded by the Home Office authorities as dangerous, for two reasons: firstly, if the materials employed are, in themselves, poisonous; and, secondly, if the conditions under which non-poisonous materials are employed render them a danger to health.

With regard to zinc, tin, and copper miners, I have little or nothing to say.

I know nothing more than I have read, and have had no opportunity for making personal observations.

My remarks, therefore, will be confined to the use of these metals for manufacturing purposes, and more especially to the employment of zinc and copper in the manufacturing of brass.

Before considering these industries in detail, it will be well to determine, if possible, how the use of the metals affects the body, and becomes dangerous to the lives of the workers.

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The great animal functions of the body are the circulation, respiration, digestion, and the nervous processes.

All hard physical labour, which makes a continual and great demand upon the muscular powers, and secondarily upon the heart, has a tendency to induce disease of the heart and blood vessels; but such a result is the outcome of any kind of physical strain, and hardly comes within the scope of a lecture like the present. It is possible that it would be wise to be on the alert that the more laborious portion of the work should not devolve upon those who are least able to stand the strain, and that care should be taken that the young who are in the stage of development, and the middle-aged in whom the natural process of physical degeneration has set in, should be kept away from that part of the work which makes the greatest demand upon the purely muscular powers.

The respiratory functions, however, come under a very different category, and it is impossible to over-estimate the importance of paying attention to the conditions under which these trades are carried on, and the influence that they exert on the respiration, and the tendency that they have to develop disease of the lungs, and the respiratory tract.

In the Out and In-patients Departments of the large Birmingham Hospitals, a very large proportion of the patients is furnished by those who are suffering from chronic chest diseases, induced by working in these metals, and especially by the manufacture of brass; and it might be well, very briefly, to put before you the nature of these diseases, and the manner in which the lungs become affected among those engaged in these trades.

It is common experience that the ease with which one breathes depends largely upon the purity of the inhaled air, and that discomfort at once results from breathing air impregnated with dust or poisonous vapours. Most people living in towns have every-day experience that the mucus at the back of the throat contains dust; but it has only recently been established that the dust can find its way into the tissues of the lungs themselves.

In 1869 Dr. Greenhow, who took much interest in, and wrote about, the trades we are discussing, satisfied himself and the medical profession that the black pigment, with which the lungs of miners are coloured, was derived from soot and smoke; and in 1878 Dr. Arlidge, whose name is so well and honourably known here, demonstrated that dust penetrated into the intimate structure of the lungs of potters and colliers.

Everyone is subjected to the inhalation of a certain amount of dust; but if this becomes constant, or excessive, lung troubles arise.

At first the dust is expelled by coughing, set up by the irritation of the air passages; but, after a time, a moderate inflammation or catarrh is set up in the bronchial tubes.

Unless dust inhalation is checked, this catarrh inevitably becomes chronic, and the lung tissue, in the immediate neighbourhood of the bronchial tubes, also becomes inflamed, and ultimately so seriously damaged, that it loses any useful function it possessed for ærating the blood, and becomes instead a focus of disease.

You are aware that the modern theory of the cause of consumption is, that it is due to a microscopic germ, the tubercle bacillus; but it is an important and hopeful fact, that though the air, and possibly the mucus in the air passages of very many, if not most of us, may contain these bacilli, it needs a deteriorated condition of the constitution, and of the lungs to give them a chance of exerting their sinister powers.

Such opportunity is afforded by the damage to the lung-tissue, which is the result of prolonged dust inhalation, or the irritation of the mucous lining of the bronchial tubes by poisonous vapours. If even consumption be not induced, it is certain that life will be rendered miserable and painful by the development of chronic bronchitis and asthma, with all their attendant sufferings.

I shall discuss more in detail, when dealing with brass work, the digestive troubles associated with it, and allude to some of the diseases of the nervous system induced by copper and zinc, but I have thought it well thus briefly to summarise what are the dangers common to all metal-workers before thoroughly considering the branches of our subject.

Brass.

The subject of the dangers of brass-casters is one of the greatest interest to those who live in manufacturing towns, such as Birmingham, where large numbers of men are employed in the brass trade. That brass-workers are exposed to unhealthy conditions is fully recognised by the men themselves, as well as by their employers, who speak of the trade as a most unhealthy one.

Brass-workers rarely attain old age, and formerly provident sick societies either altogether refused to enrol them on their lists or accepted them as members at greatly increased rates.

The recognition of working in and making brass as causative of disease is due to Dr. Headlam Greenhow, who, in 1862, read before the Royal Medical and Chirurgical Society a paper on "Brassfounders' Ague." This was based on his experience gained while paying a brief holiday visit to Birmingham in

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1858, in connection with his investigation of trades injurious to health.

It is curious that he should have selected for his title the name of a disorder which undoubtedly occurs, but which, as I shall endeavour to show, is only an acute expression of a chronic disease, and one which rarely or never comes within the range of experience of practising physicians.

In the out-patient department of the Birmingham hospitals one meets with an enormous number of brass-workers complaining of various pulmonary and gastric disorders; but in over twelve years' experience among over 50,000 patients, I have never yet been consulted by anyone in the matter of this so-called ague, although questions will very frequently elicit the statement of its occurrence.

The literature of this subject is very scanty, but Greenhow quotes Thackrah's essay on the *Effects of Arts, Trades, and Professions on Health and Longevity*, published about 1830, as well as the writings of a few Frenchmen, who have not, however, materially advanced our knowledge of the disease. Thackrah's observations were clearly inaccurate and imperfect, for he mentions only "ague," which he speaks of as an intermittent fever, attacking brass-workers from once a month to once a year, and leaving them in a state of great debility.

Dr. Hogben, Physician for out-patients at the Queen's Hospital, Birmingham, published a very interesting paper on this subject in the *Birmingham Medical Review* in May, 1887. Dr. Greenhow refers only to ague and bronchial disorders, and very cursorily to nervous troubles, as resulting from brass-casting; but Dr. Hogben mentions also the colic, constipation, and dyspeptic troubles which result from this occupation.

Dr. Greenhow, on the one hand, refers all the symptoms to intoxication by zinc, while Dr. Hogben thinks they should rather be referred to chronic copper poisoning. These two metals are the principal ingredients in the making of brass which needs a brief description.

Copper is put into crucibles, which are plunged into a sunken furnace, and covered in order to exclude the air. When the copper is melted, the crucible is removed, and zinc—about 30 per cent.—and small quantities of lead, tin, and brass dust are mixed with the molten copper, which is hot enough to melt them. When the whole mass is molten, it is poured into moulds called sows; during the pouring the zinc deflagrates, and a dense white smoke is formed, which almost instantaneously fills the atmosphere of the casting shop. This smoke is rapidly converted into snow-white flakes and white powder, consisting of the oxide of zinc, which remains for some time diffused

through the atmosphere of the shop, and, in ill-ventilated casting shops, collects upon the rafters and ceiling in the form of a dense white incrustation. The quantity of these fumes depend—first, upon the amount of zinc employed; secondly, upon the ventilation of the casting shops; thirdly, upon the weather—a dull, foggy day preventing their escape.

The shops in newly-erected factories are only one storey high, and have large sliding panels in the roof to permit free escape of the fumes; but in the older buildings they sometimes have other rooms above them, and free ventilation is impossible. It is a matter of experience that workers in ill-ventilated shops suffer much more from ague and bronchitis than those who work in the better buildings.

The men who do this work are called mixers, and protect themselves, to some extent, by tying handkerchiefs over the nose and mouth to prevent, as far as possible, inhalation of the fumes. From the mixers the work goes to the casters or founders, who re-melt the pigs of cold brass, at a lower temperature than is required for melting copper, and pour it into the sand moulds, which are faced with a fine powder of loam, charcoal, coal, and bean flour. From this powder rises a dense cloud of dust, and from the molten metal a cloud of zinc oxide, though not so much as in the mixing shop. Founders suffer principally from bronchitis, or asthma, as they call it, and ague, though in a lesser degree than the mixers. From the casters the work goes to the warehouse, where it is sorted, and sent to be polished, or dipped and bronzed. By the polishers, emery, fine sand, lime, and rouge are used on rapidly revolving brushes, or wooden wheels, faced with leather. From these considerable dust is given off, and bronchial troubles are caused; but "ague" does not affect the polishers. The dippers work under a shed, open on all sides to the air, and immerse the brass in a weak solution of sulphuric acid; it is then dipped into water, then into a stronger acid solution, again into water, once more into acid, then into a solution of soda; finally, into pure acid, and washed in water.

There are always exhalations of acid, and in warm weather these are especially troublesome. It is noteworthy that, though dippers do not suffer from ague or intestinal troubles, their occupation is considered by masters and workmen alike to be the most unhealthy of all, on account of the great bronchial irritation from the acid fumes.

From the bronzers the work is sent to the lacquerers, who are nearly always females and suffer nothing from their occupation. From them it goes to the dressers to be fitted, and finally to the warehouse. It will appear from this account of the process,

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that those who deal with the molten metal are the only ones to suffer from brass ague, while they, as well as those occupied in shops where there is much dust or acid fumes, are liable to bronchitis and asthma. Moreover, all brass-workers except dippers and lacquerers are subject to colic, constipation, and various other disturbances of the gastro-intestinal system.

That Thachrah was in error in speaking of brass ague as an intermittent affection, occurring once a month or once a year, is clearly proved by the following positive observation, which is supported by all brass-workers. Ague never occurs among the regular workers, but always affects those who are new to the work, or who resume work after an absence of even a month or a fortnight.

If a man resumes work, that is melting or casting, after even so brief an interval, he is sure to have an attack of ague, but he will only have one attack, and remain free until after his next holiday. There is most certainly no kind of regular intermission, and according to brass-workers themselves, they only suffer until they are inured to the poison.

The following are the symptoms of this so-called ague: after working a few hours, a man becomes languid, depressed and feels very cold. He is very pale and almost in a state of collapse, his face is covered with a cold perspiration, he shivers, his teeth chatter, and he is restless and anxious. His head aches, there is much nausea and complaint of muscular pains. As a rule he goes or is led home, where he drinks freely of milk and goes to bed. The symptoms continue until he has vomited, either as the result of taking an emetic or independently of it. Vomiting is usually followed by sleep or recovery, with more or less of debility and lassitude on waking.

Drs. Greenhow and Hogben speak of a more or less marked hot stage following the cold, and following the hot stage they mention profuse sweating. The hot stage may be absent, but the sweating, according to these writers, invariably occurs. My own observations, based on enquiry amongst those who have suffered from this ague, have never elicited a statement of these hot and sweating stages. Even direct questions as to their occurrence have always been met with positive negation, though some have spoken of free perspiration in the stage of collapse. How to reconcile these statements I do not know.

The cycle of events, as recorded by Greenhow, is just that of ordinary ague, from which this disease differs, otherwise than in the suggested sequence, *in toto*. The enquiries I have made do not support such a sequence, and certainly not a relationship to malarial ague. The symptoms are just such as would be caused by the ingestion of a quantity of irritant metal, sufficiently large

to cause vomiting, and its attendant depression. Such indeed, is my opinion of the causation of the symptoms, and therefore the name "ague" should not be continued, as being wrongly suggestive and misleading. It will be remembered that it is only when fresh to the work that brass-workers suffer from "ague," but, though they do not suffer from acute metallic poisoning, they do suffer from its chronic effects, and it is extremely probable that, as with arsenic and opium eaters, they may become inured to the use of the metals.

It is not very common for brass-workers to use tooth-brushes, and the accumulating tartar will be found coloured green. If every effort be made to cleanse the teeth, there will yet be generally green discolouration of them.

This has been proved to be due to the presence of copper. White hair is often coloured green among these workmen, and the underclothing is often stained green by the perspiration. The gums may be slightly blackened at the edges, but there is nothing distinctive as in the case of the blue line of lead poisoning; nor, indeed, beyond the green colouring of the hair and teeth, do brass-workers present any unequivocal evidence of their calling.

Ague is not a disorder for which brass-workers consult a medical man; they know how to treat it themselves, and also that it is transitory in its effects; but they come to hospitals in large numbers to be treated for bronchitis. About this there is nothing special. They suffer from it in common with all workers in dusty trades; and, so far as I can learn from the Secretary of the Brass-workers' Organisation, they usually die from chronic bronchitis or fibroid phthisis, unless they succumb to some acute malady.

The existence of nervous disorders, especially paralysis agitans, has been said to be common amongst them; but I cannot find that a larger percentage of brass-workers than of the rest of the community suffer from diseases of the nervous system. It is common, however, amongst them to meet with complaints of disturbance of the digestive function. They suffer from dyspepsia, loss of appetite, gastro-intestinal catarrh, nausea, vomiting, metallic taste, thirst, colic, constipation, and diarrhœa. They are often nervous and hypochondriacal, complaining of headache and muscular pains.

There is nothing distinctive about any of these disorders, except the obstinacy with which they resist ordinary methods of treatment, and the readiness with which they yield to the administration of iodide of potassium in combination with the other drugs indicated by the various conditions of ill-health. All the symptoms bear a remarkable resemblance to those

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produced by chronic copper poisoning, and in Guy and Ferrier's *Forensic Medicine*, an outbreak of copper poisoning from the use of copper vessels in cooking is recorded, in which the symptoms were almost identical with those here mentioned.

The inmates of a convent suffered severely from obstinate and severe colic, retching, and bilious vomiting, costiveness, and flatulence, burning pain in the pit of the stomach and extremities, and paralytic weakness in the arm. According to Stevenson, it is impossible to distinguish between the symptoms produced by zinc and copper poisoning. These are just such as brass-workers suffer from, and it is, therefore, impossible to say which metal—copper or zinc—is most concerned in the production of these symptoms.

Dr. Greenhow attributes them all to the inhalation of the deflagrating zinc. This forms oxide of zinc, which is only sparingly if at all soluble, and, therefore, is not likely to be freely absorbed into the stomach; but he pays little or no attention to the common and chronic gastric and intestinal troubles to which brass-workers are liable. These affect all those engaged in the various processes by which, either in vapour or in minute particles, copper and zinc—that is, brass, are distributed in the atmosphere.

Dr. Hogben, on the other hand, considers copper alone to be the efficient cause of the symptoms, and advances the following arguments—

1. We have no evidence that the internal administration of zinc ever produces the symptoms of brass-ague. Enormous doses of the oxide have been administered without apparently producing the characteristic febrile reaction of brass-ague.

2. The malady is observed in individuals whose work is other than casting.

3. The malady is not observed in operatives, such as galvanised iron workers, who work with zinc, and are exposed to its fumes.

4. Zinc is rapidly excreted, and does not, like lead, mercury or copper, become fixed in the body, and produce chronic affections.

It seems more probable that, accepting Stevenson's statement of the impossibility of distinguishing between the effects of acute copper or zinc poisoning, the symptoms of ague are due to an admixture of the two metals; whereas, for the chronic complaints, the copper is responsible. How the practice of taking milk during an attack of so-called ague has arisen is not clear; but its wisdom is proved by the fact that in cases of both copper and zinc poisoning milk is one of the best antidotes, since it precipitates both these metals into

insoluble albuminates. It is abundantly evident that brass-workers are especially liable to diseases from the use of the metals employed in its manufacture, but they are not new disorders; they are either proofs of chronic poisoning by zinc or copper, or, as in the so-called ague, are due to intoxication by them.

If more proof were wanting of the unhealthiness of brass-casters, it would be afforded by the fact, that though there are 1,200 brass-casters in Birmingham, there are not more than ten over 60 years of age.

Not long ago I met an old patient who told me, with pride, that he was 58 years of age, and that there were not half-a-dozen brass-casters in the town as old as he.

There is in connection with the Amalgamated Brass-Workers' Association a superannuation fund, from which casters can, at the age of 55, derive benefit, and I think it is an appalling fact, that there are only three men—two in Birmingham, and one in Sheffield—enjoying this benefit.

It is abundantly evident from the above description that there are real dangers to the health of brass-workers, and it is a curious coincidence with the date of this lecture, that during this autumn the whole question has been, and is being, thoroughly discussed by the Home Office, and employers and employed engaged in the brass industry.

I may take this opportunity of stating my obligation to all those concerned in this question.

Her Majesty's Inspectors of Factories in Birmingham, the Secretary of the Brass Workers' Association, Mr. W. J. Davis, masters and men alike, have given me every facility and assistance in making my investigations.

Copper.

I have had very thorough opportunities of satisfying myself as to the conditions under which copper-workers are placed, and inquiring into the troubles to which they are liable in consequence of their work. On the whole, I am convinced that it is by no means so dangerous an occupation as brass-working, the pouring of the metal is not associated with the same abundant vapours as is brass pouring, and such vapour as arises is mainly due to the presence of a small quantity of spelter in the mixture. The same precautions as advised to brass pourers should be taken; but the need is less, and I have seen a pouring shop with a perfectly clear atmosphere five minutes after the pouring has taken place. A muffler or respirator should be worn during the operation, and, as far as I have seen, this is generally done.

Apart from the pouring, I was struck by the excellent health

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of copper-workers; and as the dust is very heavy, and does not float in the air, but falls down, there are none of those respiratory troubles which, as we have seen, are the bane of brass-workers.

I have found that men had been employed in this work for a lifetime, and that it was not uncommon for men to spend over thirty years in the same employment.

There is one danger to which apparently they would be subjected; but I have found no evidence of its having arisen, from the accumulation of the heavy copper dust over the tables or boards on which the men were working. It seemed not unreasonable to expect that any want of cleanliness on the part of the workers would entail digestive troubles from the mixing of copper dust with food. As I have stated, no evidence of this is forthcoming.

It will be seen that I am unable to confirm Dr. Arlidge's view of the dangers to copper-workers from the inhalation of copper dust; nor am I able, though contrary to my own expectation, to assert that men employed in the trade are liable to suffer from colic. According to Blaudet, this colic is attended by extreme prostration—by vomiting and purging, and it is very probable that such results would follow if the men were dirty in their work and habits, by the introduction of copper dust by means of food into the stomach. Opinions are much divided on this subject, and it is possible that working in old copper and brass, which are covered with a carbonate of copper, may be responsible for the ill-effects noticed.

According to M. Perron, of Besançon, clockmakers, who have to handle copper freely, suffer from a slow intoxication from it, exhibited by gastric derangements, diarrhœa, oppression, and some feverishness; but my own experience among copper-workers and other persons, negatives these observations.

Tin.

Working in tin is practically the same as working in tin plates. Those are made by immersing thin plates of iron or steel, after they have been scoured by dipping in tanks containing sulphuric or hydrochloric acid, in baths of molten tin. This unites with the iron and coats it completely. The dangers to which those so employed are exposed, arise from the fumes of tin and from the acids used in cleansing the plates. Immersion of the hands in the acid baths whitens and hardens the skin and makes it liable to crack and to excoriations. The acid vapour reaches the eyes, nose, and throat, and irritates and inflames the mucous membranes. The teeth suffer decay, and the gums get red and soft, and acid dyspepsia is generated and toothache

is common. When the tinning of the plates is completed a process called branning follows. It is done by women while the plates are still hot, and developes clouds of dust obnoxious to the lungs.

For the above description I am indebted to Dr. Arlidge's invaluable book on the diseases of occupations, which ought to be in the hands of all interested in the subject matter of this and kindred lectures.

Dr. Arlidge suggests that many of the troubles arising from eating fruits preserved in tin boxes are produced not by the tin but by the lead employed in the soldering. Some of the salts of tin, especially stannic oxide, better known as putty powder, contain lead, and the following interesting and terrible case is a good illustration and a proof of Dr. Arlidge's contention. I was asked at the beginning of the year to see a chemist, in a large neighbouring town, suffering from lead poisoning. He was paralysed in every limb; almost in every muscle. He could not raise his head from the bed, was very anæmic and altogether alarmingly ill. He progressed under treatment with encouraging results, though the issue was hardly ever doubtful, until the nerves governing the movement of the diaphragm became affected. He rapidly developed bronchitis and a low form of pneumonia, and died in twenty-four hours. The way in which he became ill is very curious. Adjoining each other on a shelf were canisters of pepper and of putty powder or stannic oxide. By a mistake, and a not altogether remarkable mistake, the pepper mill was filled from the putty powder canister. As he was fond of pepper, and the supposed pepper was naturally weak, he took a good deal. This went on for some time until he and others of his household developed symptoms of lead poisoning, when the mistake was discovered.

This case has, of course, no bearing on the use of tin in manufacture, except in as much as it increases the probability of lead being responsible for many of the symptoms which have been attributed to the work as a cause.

Galvanised Iron.

The commercial process of coating iron with zinc, or, as it is commonly called, the process of galvanising, consists of two distinct operations—first, the preparation of the article to be galvanised, and second, the immersion in molten zinc. It must be understood that the first process is necessary from the fact that zinc will not adhere to iron until every particle of oxide or other impurity has been removed from its surface. The cleansing is effected by placing the iron to be coated in a tank, usually of stone, filled with hydrochloric or sulphuric acid

diluted with water. To facilitate the action of the acid the workman moves the iron to and fro in the tank, and removes it when clean into another tank filled with water. The second operation—or the galvanising process proper—consists in heating, in a wrought-iron vessel called a "pot," some tons of zinc to a temperature sufficiently high to render it fluid, but not so high as to cause it to deflagrate. To prevent oxidisation, as well as to facilitate the mechanical adhesion of the two metals, the surface of the molten zinc is covered with a layer of chloride of ammonium, which, on coming into contact with the molten metal, is converted into chloride of zinc. The baths being ready, the article is removed from the water, allowed to drain, but not to oxidise, and is plunged through the chloride of ammonium into the molten zinc and held there for a few moments; on removing it, it is found to be coated, or galvanised.

There are no diseases known as special to the workmen engaged in this trade, and there is no reason why the process should be injurious to the health of those who work in it. At the same time, there are acid fumes given off from the acid tanks; and the "picklers," as they are termed, who are engaged moving the iron in the acid, should, during this part of the process, place a cloth over mouth and nose.

Further, the "pot" men, who immerse the iron in the zinc, should be careful not to allow the temperature to be too high, so as to cause the metal to deflagrate when exposed, or the chloride of zinc to burn, as it gives off a pungent and irritating fume at a high temperature.

There are certain general principles which must be observed by all metal workers, such as cleanliness and care in the matter of taking food, but these need not be specially insisted upon, as the need of them is so obvious.

There are, however, some definite rules which ought to be prominently published for the guidance of those engaged in the most noxious of all the trades we have been discussing—the brass trade. These rules or instructions were summarised and brought forward tentatively by H.M. Chief Inspector of Factories, Mr. R. E. Sprague Oram. They were approved by the National Union of Amalgamated Brass-workers, but before they had been adopted they were withdrawn by an order from the Home Office, which had decided to appoint a Special Commission to consider the whole question of Brass-work. They were not withdrawn on account of being inappropriate, but solely for the reason I have given.

It is possible that the Commission may see fit to recommend some alteration, but they are so good that I reproduce them.

1. They shall provide washing conveniences, with a sufficient supply of hot and cold water, soap and towels.
2. They shall provide respirators for all persons when they are employed in pouring metal into moulds.
3. They shall provide suitable means of carrying off all noxious fumes and dust.
4. They shall provide a sufficient supply of milk, or approved sanitary drink.
5. No food shall be eaten in any part of the works where brass mixing or casting is carried on.
6. All rooms, in which brass mixing or casting is carried on, shall be limewashed every six months.

In addition to the rules affecting the health of brass-workers, there is a strong ethical objection to the present system. This has been succinctly and graphically stated to me by a prominent official of the Brass Workers' Union, and I cannot do better than repeat his own remarks:

"When a young caster is first 'put to the tub'—*i.e.*, when he is first entrusted to make his own moulds—he will also have to melt and pour his own metal. Almost invariably the effect upon him will be a kind of exhaustion. His older shop-mates, seeing his condition, will, ten to one, advise him to 'go and have a pint.' He does so, and, for the moment, the beer refreshes and stimulates him. Naturally, when the sulphur renews its deleterious work upon his system, he flies to the same remedy again, and thus, in many cases, a taste is induced which ends in his becoming addicted to alcohol. If milk, or other approved sanitary drink were substituted, the dangerous first pint would be avoided, and there is at least a probability that many of those who fall, would remain sober and respectable members of society."

Rule No. 5, which says that no food shall be eaten in any part of the works where brass-casting or mixing is carried on, is a most important one, and it is quite clear that the rules ought to be enforced and that casters ought to be prevented by law from taking their meals in the casting shops. In a general way a caster gets into the habit of having no regular meal hours as other workmen have, because from the time he begins in the morning until he has poured his last heat he can scarcely take his attention from his work. Some process or other, such as punning sand, making cases, moulding his odd side, mixing and stirring his metal, &c., has always to be taken up in time so as to dovetail with the other parts of the work. As most of the operations are severely laborious, the workman, anxious to get on, despite his being in a grimed and heated condition, is tempted to snatch his mid-day meal how he can.

He will perhaps sit upon the spilling hearth and eat a portion of his dinner; then go on with something that wants doing, and return to it; thus perhaps making the meal spread over a considerable time with many intervals. Food thus exposed will necessarily receive some injurious deposit from the poisonous particles which are always floating about a casting shop while work is going on. A piece of bread, or bread and butter, left uncovered in such a shop during an average working hour, would be found to be coated with a greyish substance consisting mainly of the powdered oxide of zinc, and it must be clear that food in such a condition is highly unfit for human consumption.

Regulations which break the continuity of work and seem to hinder the workman might not be acceptable to him, but still they ought to be insisted upon for health's sake. It ought to be *sine quâ non* that no meals should be taken in the casting shop, and that consequently proper accommodation should be provided elsewhere. Besides the caster himself, there are others to be considered—his assistants, if he has any—who work in the same shop and under the same conditions.

It may be urged that such a requirement would press hardly upon the small tradesmen, such as an out-caster, whose casting shop constitutes the whole of his working premises. But this is the very thing which the larger and more reputable houses complain of, that the small trader undersells them by reason that he is under less expense through having no regard for his workpeople. Sympathy for the struggling tradesman is all very well, but he should not be allowed to make his way by the sacrifice of human lives. If, as is too generally the case, the shops of these small employers are badly constructed and ill-ventilated, then, for the sake of those employed in them and for the general good of the trade and of the community, the sooner they are closed the better.

The unhealthy conditions to which casters are subjected have been of late years greatly augmented, through the practice of giving out scrap materials for the caster to mix his own metal as he goes on with his own work, instead of giving out to him "pig" or ingot metal, which is the custom observed in the best regulated factories at the present time. This scrap material consists of substances such as corroded locomotive tubes filled with verdigris, disused naval appliances, &c., coated with deleterious substances, such as arsenic, &c.. During the mixing process these impurities are given off and impregnate the air of the casting shop, the effect on the workmen being most injurious.

No scrap should be given to the casters; but it should be

properly cleansed, refined, and smelted, and issued to him in the form of ingot.

Rules 1 and 6 need no discussion as to their propriety. There ought to be no difficulty in the way of their being carried out.

Milk is, I believe, the most efficient means at our disposal for neutralising the ill effects of the vapours and dust of a brass casting shop on the digestion, and should I think be supplied, and its use be enforced.

The respirator would to a considerable extent diminish the evil effects of casting on the lungs.

About the necessity of using respirators there can be no question, though a muffler worn over the mouth and nose is a not inefficient substitute. All these regulations are, however, of less importance than Rule 3, which insists that suitable means shall be provided for carrying off all noxious fumes and dust.

It will appear from a general consideration of brass manufacture that the formation of deflagrating zinc cannot be avoided, and that there must always remain a certain risk of pulmonary disorders, bronchitis, asthma and consumption among those so employed, but it is very certain that these evils can be minimised, and it is the duty of the State to issue regulations to effect this; while it will remain for Sanitary Inspectors and Inspectors of Factories to see these regulations carried into practice. If the deflagration of zinc cannot be avoided, it is possible by efficient ventilation to facilitate the escape of the poisonous atmosphere, and it is to efficient ventilation that our attention must be directed. For this reason it is in the highest degree important that casting shops should be lofty, and should have either a movable or sliding roof and large open windows or spaces.

In the old days the casting was often done in the lower storey of a two-storied building. No more certain way to damage the health of the workers could be devised, and it is greatly to the credit of the manufacturers that in the Birmingham district they have in many cases converted a poisonous workshop into a healthy and lofty one by removing the flooring between the two storeys, but even now a good deal of mixing is done in the cellars of small houses.

It seems a hardship to discourage individual enterprise, but the law ought to forbid the possibility of such an arrangement, and it should be the earnest endeavour of every Inspector to prevent the existence of such an abuse, by his knowledge of the evils of the proceedings and by his promptitude in exposing it.

COAL MINING, AND THE HEALTH OF COLLIERS.

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One of a course of five lectures on The Sanitation of Industries and Occupations.

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ABRIDGED.

The subject I have to bring before you is an important and at the same time a very wide one. A knowledge of the working of a coal mine is by no means easily attained by a layman, and I cannot pretend to have acquired anything like the acquaintance with this very intricate matter that one trained in mining would possess. For many years, however, the miner and his work has been to me a subject of the greatest interest, and my knowledge has been gained by personal contact with these underground workers who have passed under my professional observation in large numbers—getting into thousands—and by occasional visits to the mine itself. For the purposes of this lecture, moreover, I have fortified myself by calling to my aid the kind offices of valued colliery friends and medical men who by living among, and attending professionally to, miners have been able to give me most valuable assistance.

As late as the close of the seventeenth century coal was mostly employed, or almost entirely, for household heating purposes. The uses to which steam was put and the manufacture of iron and steel, led to its immensely greater production, until to-day it stands forth as perhaps the most important industry in the country. We need recollect only the long continued strike of last year to witness the extent of its immediate and indirect effects upon the trade of the country. As years pass along also the numbers engaged in coal mines increase. In 1890 there were over a half-million employed underground, the additional number since 1869 being no less than 200,000, the exact figures being, 1869, 300,000; 1879, 385,179; in 1890, 506,812; and in 1893, 549,738.

The relation of the miners' occupation to health has received attention among others at the hands of Drs. Farr and Greenhow, who were pioneers on this subject, by Dr. Ogle whose work is deservedly so often referred to, by Dr. Arlidge in his invaluable work on the Diseases of Occupations, and by Dr. Nasmyth.

We shall mention at the outset the conditions of labour in the mine and then discuss whether these same conditions act prejudicially on health, and if so, consider the diseases to which they give rise.

The number of the workers about mines may be roughly estimated as about 680,000.* Of these 133,000 will be employed on the pit top, whilst the remaining 550,000 will pursue their avocation underground and be classed as miners. The conditions at once apparent about the miners' work are these: (1) that it is labour pursued underground; (2) consequently it is carried on by artificial light oftentimes not the best; (3) that the working places and the levels or roads which the men traverse are frequently low and need a stooping carriage; (4) that the work of coal getting is pursued in a constrained position; (5) that the atmosphere is more or less vitiated and impregnated with deleterious gases and is a dust laden one. A mine is generally worked in "shifts." Occasionally there may be three shifts but generally not more than two,† and frequently only one.

For our purpose all employed underground are regarded as miners. The work performed is, however, of various kinds. On reaching the pit bottom after descending the shaft in the cage the "onsetter" is met with, whose duty it is to see to the despatch upwards of the full and the descent of the empty tubs. Then there are men who attend to the roads, the labourers or "datallers," the "trammers" who despatch the tubs filled with coal from the working places, and the "fillers" who put the coal into them, and lastly also the "drivers" or "pony boys."

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* The actual number for 1893 was 683,008; 549,738 underground, 133,270 above ground, of these latter 4,725 were females. The average for the last ten years compared with the ten years previous shows a decrease in females of 1060. No females are employed underground.

† Mr. A. H. Stokes, H.M. Inspector of Mines, tells me that in his (the Midland) district nearly all the mines have one shift of coal getters, &c., and one shift in the night of repairers. He gives me the following details of a three shift pit, the only one he thinks in his district. Pit working double shift of coal getters and one shift repairers: Banks men.—Coal drawing from 6.30 a.m. to 7 p.m. Meals, a quarter of an hour at 8 a.m., 12 noon and 4.30 p.m. Coal getters, workers, &c. (1st shift).—Miners get down by 6.15 a.m.; get out by 2.30 p.m. Coal workers (2nd shift).—Miners, fillers, draymen and boys get down by 3.30 p.m.; get out by 9.30 or 10 p.m. Repairers (3rd shift).—Draymen or repairers go down at 9 p.m.; get out at 5 a.m.

The men engaged at the coal face are the "fillers" just mentioned and the "coal-getters." These latter are the men upon whom practically all the others wait as they are the winners of the coal or "coal-getters." Their work is the most constrained, as in order to bring the mineral down in as large pieces as possible it is necessary to undercut or excavate the coal seam. To do this it is required of them that they should lie on one side, or the other, and they have to draw their bodies into the hole they have thus made under the seam and to continue the excavation to the depth of 3 to 8 feet. This process is called "holing."

A mine is lighted either by "naked lights" or by "safety lamps." Generally the "naked lights" used in England are candles, but occasionally open lamps or "torches" as they are called are used. Safety lamps are always required in fiery mines, and their employment is becoming much more general. Their construction varies considerably, but the essential points in all modern safety lamps are that the lower part is glass and the gauze at the upper part is protected by a metal casing or "bonnet," this latter being required in consequence of the more rapid currents of air which improved ventilation has brought about in mines. The light afforded by a safety lamp as used to-day is a great advance on that given by the old Davy, but still there is room for further improvement. It is of importance to bear in mind that many of the roads in a mine except main roads from the pit bottom are low, and that to traverse them it is necessary for a man, even below the average height, to stoop to pass along them. The same remark applies to the working places at the coal face, where of course the height corresponds with the thickness of the coal seam, and will vary with the seam from 3 feet to about 4 feet 6 inches, more or less.

Leaving accidents alone for the moment, let us consider the effect of the influence of pit life on the general health of the miner. Dr. Ogle's opinion after a consideration of the facts revealed by the census statistics of 1881 is well known. "The death-rates of coal miners" he says "are surprisingly low. In spite of their terrible liability to accident and their constant exposure to an atmosphere vitiated by coal dust, by foul air, and by excessively high temperature, the comparative mortality figure of these labourers is considerably below that of all males; nor is this only true of coal miners in the aggregate, but it is true with one single exception for the miners in each great coal area taken separately." The exception he refers to is furnished by South Wales and Monmouthshire and even here "the rule holds good" if accidents be excluded, as the mortality of miners from all other causes together is below that of the general male

population. Dr. Ogle goes on to show "that if we exclude accidents the mortality of the coal miners only slightly exceeds that of the most healthy class, viz., the agriculturalists, that is to say the farmer, the agricultural labourers and the gardeners."

It is said with truth that in a sense miners are picked men. Boys of poor physique would hardly be likely to undertake a labour involving such arduous work. But I do not think too much should be made of this. It would refer to many other occupations even if with less force. Another point that is sometimes mentioned is that old miners are not frequently met with, at all events, pursuing their work. I can hardly accept this as correct, because my enquiry shows that, as in any other occupation, a man will find employment as long as he is able to fulfil his duties, and in the mine a man can change from the laborious work required of the coal getter to one less irksome. That there are a great number of aged men employed about mines is shown in the evidence afforded by superannuation societies. Mr. Watson, of Barnsley, has written a paper dealing with this matter in Durham and Northumberland. The requirements for a miner to obtain an annuity of £13 a year were three: 1st, his age must be not less than 65; 2nd, he must be incapable of working; and 3rd, his membership in the Permanent Society must be not less than seven years. In 1888, 91,637 persons, old and young, were paying to this Superannuation Fund, and no fewer than 2,280 aged miners were being supported out of it. Approaching the subject from an Actuary's point of view, Mr. Neison, in a recent paper, said that statistics showed that during the working period of life, viz., the years before the attainment of 65, the occupation of mining as a whole was not of an unhealthy character, and demonstrates that the longevity of miners is not below the standard of the whole population. "Taking a group of miners of a general age-distribution nearly one-half," he affirmed, "would survive at sixty-five." Many he thought left the occupation before attaining the age mentioned for pursuits entailing less continuous hard work, but "others again literally die in harness, working up to quite an advanced age." An investigation into the experience of Friendly Societies as to the proportion of their members over sixty-five years of age suffering from protracted incapacity for labour showed that nearly one-third of the members came within this classification. Further the rate of mortality prevailing amongst this section was found to be not dissimiliar to the high rate operating among the aged and infirm miners.

He gives the following table as to the age-distribution of the

mining population as compared with the general male population of England and Wales.

To every 1000 persons (males) the age-distribution of those employed in connection with coal and iron stone mines.

Ages.	1881	1891	Whole population England and Wales 1881	Whole population England and Wales 1891
15—24	353	365	301	302
25—44	454	447	409	412
45—64	172	170	222	218
65 upwards	21	18	68	68
Totals	1000	1000	1000	1000

Statistics as to the general sickness rate of miners are not so easy to obtain as rates of mortality. It appears that sick clubs recognise the fact that accidents to which miners are exposed render them a somewhat greater drain upon the funds than the ordinary members, and accordingly a small extra charge is made to them. Recently the Sheffield Equalised Druids examined this question. The Society has among its members a large number of miners. From the report it appears that according to Ratcliffe's miners' experience the average sickness is eight days and twenty hours against six days and ten hours for ordinary members each year. The Committee of the Druids Society found that their experience at the same ages was seven days and twenty-one hours for ordinary members and for miners alone nine days nine hours sick per member per year, showing that the miners have had one day twelve hours more than the ordinary experience of the Society.*

Accidents may well be credited with this increased sickness run upon Friendly Societies. To obtain information for the purpose of this lecture I issued to about twenty medical friends connected with collieries a series of questions. Those to whom they were addressed resided in all parts, from Scotland in the North, to South Wales, and different coal districts in England. From the replies with which they kindly favoured me, it is clear

* It was stated by the Vice-President of the National Association of Colliery Managers that when the Ancient Order of Foresters proposed an increase in the contributions of miners, on the score of the unhealthy nature of their occupation, the miners themselves produced figures to prove that this was not justifiable. In the joint conferences held between representative Coal Owners and the Miners' Federation on the eight hours' question in 1891, the coal owners stated that as far as they had ascertained, only one Life Assurance Company (*i.e.*, The Scottish Temperance Insurance Company) makes an extra charge in the case of miners and railway servants, and that of one per cent. (Labour Commission, Summaries of Evidence, page 53).

that in their opinion the general sickness rate of a mining community compares not unfavourably with those of the populace generally.*

Phthisis.

The influence of dust, whether metallic or non-metallic, in the production of phthisis is now well known, and the subject received attention in these lectures last year. A collier passes a third of his day in an atmosphere which is laden with fine particles of coal dust. Mines differ very much in the prevalence of this dust. Thus men speak of the mines in which they work being dusty or not. A dry mine will be dusty, and a wet not so much so. That colliers will be constantly breathing these fine particles cannot be questioned, and yet Dr. Ogle says "that be the explanation what it may there can be no possibility of doubt that the mortality of coal miners from phthisis is remarkably low." This is amply borne out by the table—given by Dr. Ogle at pages xxx—xxxiii of the supplement to the 45th Annual Report of the English Registrar-General.

These figures not only show the small mortality of coal miners from phthisis as compared with the workers in other dust laden atmospheres, but their near approach to fishermen, a class of men particularly free from this disorder. The difference between the coal miner and the Cornish miner is most distinct. For every collier that succumbs to phthisis no fewer than 5½ Cornish miners will fall victims to the same disease.

Dr. Nasmyth who has had a large experience of colliers, having been engaged for many years in a coal mining district, has gone into the subject now under consideration, and has given some valuable data.†

His general conclusion is that in the fifteen years passed under review, "It cannot be said that a high death-rate has prevailed in a population largely employed in coal mining, but quite the reverse; and these statistics go to disprove what at one time was generally accepted as a fact that coal mining was productive of phthisis."

The opinion of medical men to whom I have applied, as before mentioned, is unanimous as to the freedom of the coal

* I must here record my indebtedness for kind assistance to the following: Drs. Nasmyth (Cupar), Simons (Merthyr Tydfil), Makeig Jones (Wath), Cheesewright (Rawmarsh), Goodall (Chesterfield), Scott (Woodhouse), Hunter Walker (Worksop), McCall (Conisbro), Justin McCarthy (Wellington, Salop), J. A. Smith (Wakefield), Menzies (Worksop), Hale (Staveley), Gardiner (Beighton), Bankes (Aberdare), Walford (Alfreton), Halton (Barnsley).

† Annual Report (1892) of the Medical Officer of Health for the County of Fife.

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miner from phthisis, and these opinions represent practically all parts of Great Britain.

The air of coal mines received very careful analysis at the hands of Dr. Angus Smith. This was as far back as 1863, and the air was undoubtedly as he found it very bad and can scarcely be compared with the condition at the present day.

Dr. Nasmyth* made a very exhaustive examination of the air in the Fifeshire mines, which may, he says, be taken as an indication of the state of the air in the mines for the rest of Scotland and, in all probality, for English mines also.

The average results of his examinations showed:

Carbonic acid in moderately deep mines ...	0·181 %
Carbonic acid in deep mines over 100 fathoms	0·219 %
Oxygen in deep mines	20·40 %

Oxygen required to oxidise 1,000,000 volumes of air:

Moderately deep mines	·30 %
Deep mines	·39 %

The thermometric observations are very interesting. They were made between September and the following January. The highest point registered in the mine was 55°·5, and the lowest 53°; this last being recorded on twenty-one consecutive days, thus showing a remarkable uniformity of temperature. On one occasion while above ground the thermometer registered 25°, in the mine it registered 53°; but on another occasion the difference was only half a degree. Whilst therefore the temperature above ground fluctuated that in the mine remained fairly uniform; an important point, as men working under such conditions would not be exposed to chills and varying temperatures. Against this must be set the humidity of the mine, and also that men have often to work in wet places, and that in the main roads and when waiting at the pit bottom to ascend, they are often when insufficiently clad exposed to currents of air.

Dr. Nasmyth found micro-organisms varied according to the air currents; in a good current the colonies were few, where the air was more stagnant they were plentiful, and the presence of men and horses had a marked effect in increasing the numbers and kind of colonies. Taking it altogether, Dr. Nasmyth holds that whereas the air of coal mines twenty or thirty years ago was bad when ventilation was little adopted, now with properly directed currents of air it is widely different.

He thinks, moreover, that the conditions connected with a miner's occupation are as favourable to health as those in the

* British Medical Journal, Vol. II., 1888, p. 222.

occupation of any other workmen, an opinion which is borne out, he maintains, by vital statistics. He mentions the interesting and well known fact that horses and ponies underground soon improve in condition with their coats shining, which is certainly not due to grooming, as they do not get it. He has known ponies to be twenty years underground, and this at a time when ventilation was bad and when the hours of labour were longer.

It is clear from what has just been said that, though working underground, the miner pursues his avocation under not only widely improved conditions to what was formerly the case, but that with a fairly even temperature, he has to a certain extent an advantage over those whose employment necessitates exposure to all weathers and changes of temperature. Also the present methods of ventilation are such as to render the air of mines by no means so impure as might have been supposed.

The freedom of the miner from phthisis is a fact that hardly admits of dispute. Nor can this be got rid of by assuming as a reason that the miners are more or less picked men. The rarity of phthisis among miners is shown by the answers obtained by me from the medical men to whom inquiries had been addressed. Not one of these medical men admits to phthisis being anything but infrequent.

It has been asserted that the coal dust acts as a preventive to the development of phthisis. Be this as it may, and there is not evidence sufficient that I know of to prove the statement, yet it is abundantly clear that the dust of coal is very different from that that men engaged in metallic and other occupations have to breathe. The particles are not sharp, and are less penetrating, nor are they pungent and irritant like some other substances. It is a matter of daily observation that coal dust may be rubbed into accidental wounds, or lie embedded under the skin for years without the slightest irritation.

Respiratory Diseases other than Phthisis.

In affections of the lungs other than phthisis, there appears little doubt that the miner fares worse than he has been shown to do under this disorder. Whereas the mean comparative mortality figure for all males is 182, Dr. Ogle gives that of coal miners at 202; and from the reports sent to me by medical friends, the opinion current among them is that the collier is liable perhaps more than others to bronchitis, especially in those getting on in life, and that pneumonia is prevalent in all ages. If however we take the tables prepared by Dr. Ogle, we see that among dust laden occupations only the carpenters, bakers, and masons have a less death-rate from respiratory

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diseases than the coal miner. Dr. Ogle thinks that the actual death-rate from respiratory diseases should be higher than the figures given, and his idea is that among the deaths returned as phthisis are to be found many cases which should more properly have been classed with the disorders now under consideration. Be this as it may, it would reduce the percentage of deaths from phthisis, and in no way detract from the general statement which has been set forth as to the healthiness of the miner's occupation.

The following table gives the comparative mortality figure for each of the six great colliery districts* :—

Comparative Mortality from Respiratory Diseases.

Fishermen	90
Farmer	99
Miner, Durham	122
„ Lancashire	229
„ West Riding	172
„ Derbyshire	138
„ Staffordshire	260
„ S. Wales and Monmouthshire	293
Cornish Miner	458

This table again sets forth the wide difference as to mortality between the coal miner and the Cornish metalliferous miner. Respiratory diseases appear to be more frequent in dry and dusty mines. Though the particles of coal dust are not of so sharp and penetrating a character as are metallic particles, and the miner perhaps for this reason is in a great measure exempt from phthisis; yet their inhalation will no doubt be a prominent cause of the bronchial catarrh and indirectly of the emphysema from which miners suffer. The black particles settle on the mucous membrane of the bronchi even if they do not always penetrate into the lung tissue and give rise to the "black spit" so often seen in miners. Among other causes may be mentioned damp, and standing in cold currents of air when insufficiently clad.

Diseases of the Circulatory System.

In Dr. Ogle's mortality tables the miner appears to advantage from these diseases. His comparative figure from these diseases is much below that for all males, which is 120; the miners' rate is 105 (Durham) and only 59 (Derbyshire). It is very little higher than the farmer and grazier at 84, and the draper at 75, and the printer at 93. The agricultural labourer stands at 97.

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* Op. cit., page 58.

The table gives the various rates from the six coal districts.

Durham	105
Lancashire	96
West Riding	88
Derbyshire	59
Staffordshire	104
South Wales and Monmouthshire... ...	120

Even South Wales, the highest, is only up to the average rate for all males. Apart from this, however, the miner is, as is abundantly evident to those who see much of his ailments, prone to cardiac disorders. This is hardly to be wondered at considering the hard work he undertakes, pursued as it is with limbs and body cramped, and in a way rather to impede than promote a healthy circulation. To be added to this is the lifting, pushing, and dragging which forms such a notable part of the occupation of the miner. The tubs filled with coal for instance require no little effort to push them along, and especially is this the case when it is necessary to start one of these "corves." There is indeed abundant opportunity for the production of the form of heart affection which is observed in other occupations as the result of overstrain. Valvular disease is therefore met with, but not perhaps more frequently than is the case in other members of society.

Functional disorders of the heart are much more commonly observed. Miners present themselves with a rapid pulsating heart, with shortness of breath, general weakness and unfitness for work. The frequency of this functional disorder is attested to by the medical friends of whom inquiries were made. I have seen several among my patients attending for eye affections, and my colleague, Dr. Cocking, who has paid special attention to this disorder in those who have presented themselves among the medical patients at the Sheffield General Infirmary, has given me his opinion that men suffering in the manner mentioned are unfit for their employment, but that under rest from their work the heart slowly recovers a normal condition. Looking through the replies of my medical friends, it is observed that perhaps all are of opinion that organic affections of the heart are not more common among miners than is the case in the ordinary population, but that functional disorders are frequent.

Dyspepsia.

To this disorder, according to the information accessible to me, the miner is very subject. He takes with him into the mine a supply of food which he consumes half-way between the

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time he spends underground. This he often eats quickly, returning at once to his work, and it consists not uncommonly of bacon, cheese, or pastry, washed down with a liberal supply of tea. All my friends consider this dyspepsia to be common, and to be due to over-eating and to indigestible food; I should add the cramped position which the miner will often occupy just after he has partaken of his "snap" in the mine. The consumption of injudicious food is not confined to the pit, but also occurs at their homes. The miner is a great meat eater when trade is good. Besides this, he adds a liberal use of beer indulged in chiefly at the end of the week, but by others the public house is visited either as soon as they ascend from the mine, or in the evening.

The miner notwithstanding all this comes out well when the mortality tables are considered. The comparative mortality figure for all males from liver diseases is in Dr. Ogle's table returned as thirty-nine. The miners in the six great colliery districts vary from fourteen to twenty-four; while for the affections classed in the table as "other diseases of the digestive system," miners are again below the average.

Alcoholism.

Here again the average death-rate of the miner is below that of the general rate for males. This is somewhat surprising when the well-known habits of the miner are remembered, but it appears that indulgence is greatest among the younger men.

Urinary System and Nervous System.

The miners' mortality rate for diseases of the urinary system and of the nervous system is below the average given by Dr. Ogle for males generally.

The foregoing will have shown that the contention, that the miner's occupation is by no means an unhealthy one, is well supported. On this point the opinion of the medical friends whose aid was solicited is of interest. Fourteen of sixteen answers received unreservedly express the opinion that in their judgment the occupation of the miner as far as health is concerned compares favourably with other employments. One of the exceptions put in a reservation for heart complaints.

The habits of the miner have perhaps been sufficiently referred to. On ceasing work and leaving the mine, he will wrap himself up and thus guard against exposure to the keener atmosphere he then meets. The houses they live in are often small with low rooms, and are overcrowded. Dr. Ogle has shown that they marry early and have large families.

Miners' Nystagmus.

This affection, though occasionally met with as an acquired disorder in the workers in other callings, is so much more frequently found among coal miners that it may veritably be *called a disease of miners.* It is in fact *the* disease of colliers. To this subject I have devoted a great deal of attention, and my observations were published, besides several papers previously, in a volume not long since.* The views then set forth and which will be briefly now mentioned, have received support from the researches carried on about the same time, but independently, by Nieden in Germany, Dransart in France, and others.

The disease is characterised by rapid motions of the eye-balls, the movements being brought about or aggravated by the patient looking upwards, and lessened or stayed by the gaze being cast downwards. To the patient the impression is given of objects upon which he fixes his gaze, moving generally in a circle, and this condition in many cases leads to so much giddiness and discomfort at work, that the miner has to desist and leave the mine. It is fortunately a malady that admits in the bulk of the cases of relief by either changing the kind of work performed in the mine, or for a time relinquishing employment in the pit. It is usually met with in men who have worked in the mine for some years, but it is occasionally observed in those whose time underground has been much more limited. Ninety per cent. are found in miners between the ages of twenty-five and forty-five. Though cases occur in other workers in the mine, and among these the "deputies" to be presently referred to, yet the disorder is as a rule observed in the "coal-getters," and it is this fact that gives the clue to the causation of the malady. These men, as was mentioned previously, are engaged in getting the coal down, and for this purpose, and to win it in as large pieces as possible, they excavate or "hole" the seam of coal at the bottom.† This undercutting of the coal is continued for some feet, and the miner beginning by sitting down and striking the coal with a horizontal swing of the pick at the bottom of the seam gradually draws his body underneath the coal lying on one or other of his sides, with the head flexed upon the underlying shoulder, and the eyes following the point at which the pick is striking will assume a direction upwards,

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* "Miners' Nystagmus, and its relation to position at work, and the manner of Illumination." (Wright & Co., Bristol.) Illustrated by photographs taken in the mine, &c.

† There are three kinds of "holing":—At the bottom of the seam, "bottom holing;" at the top, "top holing;" and there is "middle holing."

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and more or less obliquely. By upwards is meant towards the vertex, and it is this upward and oblique direction of the eyes, necessitated by the miner's work for long periods, that is the prime cause of the malady, for by it a weariness is induced in the elevator muscles of the eye-ball, and the oscillations of the globes thus result. The disorder is met with in mines in which various forms of light are in use. Thus it is observed in the workers with "safety lamps," candles, open lamps, "torches," in places lighted well with large paraffin lamps, and even in men working with gas light. This fact, together with the peculiar character of the oscillations of the eye-balls, prevents the manner of illumination in the mine being accepted as a main contributor towards the causation of the disorder. The worse the light, however, the more will the effects of strain be experienced, and hence other things as to work being equal, nystagmus will be found more frequent with the worse form of lighting. Nieden gives the proportion of men affected as five per cent., but counting the mild cases which do not interfere, or only slightly, with work, the numbers for many mines in England will exceed the estimate here given. The malady has an important bearing in that it is a cause of men becoming recipients of club relief for in some cases a considerable time.

In addition to the eye tremor just mentioned, there are other muscular conditions observed in the miner, which must be put down to the manner of his work. Associated frequently with nystagmus are observed, for instance, tremors of the head; a like condition is noticed in the muscles of the face and neck, and occasionally torticollis is met with. "Pick palsy" of the muscles of the arm is another form of occupation neurosis seen in the miner.

Miners also are subject to inflamed bursæ over the patella from kneeling, and also to a like condition over the olecranon from resting the elbow on the floor whilst striking with the pick. This latter is called "miner's elbow."

Accidents.

The workers in coal mines are peculiarly liable to accidents, and the mortality from this cause is a very high one. Dr. Ogle's table shows that whilst the proportion of 1,000 deaths of males generally between the ages of twenty-five and sixty-five from accident is 67, that of miners, taking South Wales, which is the highest of the mining districts, is 229, or more than three times the average. Fishermen, the next most liable to fatal accident, are a good deal below the miner.

It is further seen that the proportion of accidents under-

ground is greatly in excess of that among those employed among machinery and railways at or about the top of the mine.

The figures work out as follows:—

Per 1,000 men.

	Underground.	Above ground.	Per 1,000,000 tons raised.
1893	1,709	900	6·043
1892	1,645	834	5·110

The total number of accidents from all causes underground in 1893 was 940, out of a total number employed of 549,738; whilst the number of fatal accidents amongst those employed at the surface was 120 out of 133,270.

A table given by Dr. Ogle (op. cit. page liii.) sets forth the deaths from accidents, with the ages of the miners involved.

This table shows that the younger hands employed are those particularly that go to swell the aggregate number of fatal accidents. This will have to be referred to again when considering skilled labour in the mine. The second point is the large proportion of the total fatal accidents that is due to falls of roof and sides. In Scotland it was stated before the Labour Commission, that no fewer than fifty per cent. of the fatal mine accidents were due to this cause. It is also found that in the returns based upon the Reports of the Mine Inspectors for 1893 out of the total number of fatal accidents 1060, there were returned 412 as caused by falls of roof and sides. In 1892 the numbers were somewhat in excess, viz., 435 out of 1016 fatal accidents.* In 1878 the ratio was 1 in 294, but in 1891 it was reduced to 1 in 388. The number of deaths in a given year from explosions is of course subject to great variation, a large colliery disaster sending the rate from this cause up, and very materially affecting also the general death-rate from accidents. Fatalities resulting from mishaps in the shaft, cage, &c., amounted in 1893 to no fewer than 103 out of the total of 1060. A consideration of the number of men who descend into and ascend from all the mines in the country in the course of one day only will create some surprise that this figure is not in reality larger. In his Report as Inspector for the Midland District for the last year, Mr. A. H. Stokes remarks on the decrease of accidents in shafts of three from the previous year, the number for the year under review being five. He proceeds to say "the small number of accidents in shafts is remarkable when we consider that upon every working day in the district

* The following comparison with other trades is interesting:—
Fatal accidents on the sea, 1 in 115 (1892); do. on railways, 1 in 543 (1893); do. in metalliferous mines, 1 in 5[illegible]0 (1893); do. coal mines, 1 in 644 (1893).—Mr. Brain, "Colliery Manager," September, 1894, page 175.

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upwards of 60,000 persons are lowered and raised through shafts."

Many of the accidents resulting from falls of coal are without doubt due to carelessness on the part of the miner. It is impossible to read the reports of the inquiries which follow fatal accidents without being struck by this fact. Neglect in setting proper supports, or "spraggs" as they are called, in sufficient proximity to each other, and in failing to observe the dangerous condition of the roof, are causes of these mishaps. But besides this, the character of the coal and of the roof, whether hard or not, are factors to be remembered. In Wales the roofs are stated to be very treacherous, especially in the steam coal collieries. The evidence before the Labour Commission showed that the diminution of accidents, and the general improvement of mining was largely due to the different Coal Mines Regulation Acts. These Acts have failed, however, to prevent the employment of unskilled workmen, and this is a matter upon which the miners and their representatives feel very strongly. It was even stated before the Labour Commission that a considerable number of the accidents in South Wales, where, as has been said, the greatest proportion occurs, may be traced to the increasing number of unskilled workmen who manage to obtain employment.

Before passing from fatal accidents, a matter remains to be mentioned. It is interesting to observe, in view of the statements that are made and which are combatted in the Report of the Labour Commission, that the accidents are not influenced in any material degree by the time the men may be at work. For 1893 and 1892 the figures work out as follows:—

	1st hour.	2nd hour.	3rd hour.	4th hour.	5th hour.	6th hour.	7th hour.
1893 ...	81	77	85	71	72	92	70
1892 ...	68	73	94	90	92	91	75

	8th hour.	9th hour.	10th hour.	11th hour.	12th hour.	More than 12th hour.
1893	54	45	35	8	—	—
1892	66	56	25	3	2	4

Besides the fatal accidents, those less severe from which recovery takes place form a large part of the ailments of the miner. Klostermann speaking of coal mining in Germany (Bochum district), said that accidents formed a quarter of all the ailments of the coal miner, and there is no reason to suppose that the proportion is less for this country. The opportunities for accidents to body or limb in the mine are multitudinous. At the coal face, injury to limb or body by pieces of coal or stone; and in filling and tramming, trapping of fingers and jamming of legs and feet, are of frequent occurrence.

Explosions.

The air of a coal pit is apt to be rendered impure by various circumstances. Among these may be mentioned the fact of the large number of human beings, in addition to the horses, who pass their time underground. The horses are stabled below, and are rarely taken up. Besides the effluvia from the cattle it must be remembered that the miner spends a third of the twenty-four hours in the mine and the calls of nature are there responded to. Excreta are passed at any place, and sometimes covered over and as often as not by small coal. This appears to me a matter about which improvement might take place.

The atmospheric air, moreover, in the mine becomes charged more or less with certain gases. Carbon dioxide is known to the miner as "black" or "choke damp" or "stythe." Carbon monoxide or "white damp" is more deadly and less frequently met with than carbonic acid. It results from imperfect combustion and especially spontaneous ignition. Sulphuretted hydrogen is at once detected by its smell, and arises from decomposition of iron pyrites and from the imperfect combustion of gunpowder. Light carburetted hydrogen or fire damp is commonly found in coal mines and is the cause of the explosions attended too frequently with such great loss of life. Under the name of "after-damp" is included all the products from ignition of an explosive mixture. Carbon monoxide and dioxide figure amongst its constituents, as does also light carburetted hydrogen. The miners who escape the effects of an explosion fall victims to this after-damp and in this way it is responsible for more deaths than directly result from the explosion.

To combat the conditions thus briefly mentioned and to dilute any gases as much as possible the ventilation of mines has naturally received a great amount of attention, and the success which has followed the adoption of such methods as are in use at the present day is set forth in the valuable article by Dr. Nasmyth already alluded to, which shows the greatly improved state of the air in coal mines to-day compared with even twenty years ago. The superior means adopted in the deep pits where a current varying from 100,000 to 300,000 cubic feet a minute is circulated through the workings diminishes greatly the chances of explosions, but at the same time when gas is actually ignited this same ventilation serves to supply the oxygen for the maximum intensity of flame.

The relation of coal dust to explosions is still a subject receiving a good deal of attention. The whole matter of explosions has received exhaustive treatment in the Report of

the recent Prussian Commission on Fire-damp. They give the causes of the production and the accumulation of fire-damp as follows:—

1. Continuous evolution of marsh gas without extraordinary accumulation.
2. Boring into fissures, blowers, &c.
3. Falls of roof.
4. Evolution of fire-damp from goaf or from large accumulations.
5. Accumulations resulting from the stoppage of works.
6. Accumulations behind heaps of coal, or stone, or timbering, or in the sump.
7. Accidental disturbances of the ventilation.
8. The leaving open of air doors.
9. Miscellaneous forms of neglect in the ventilation, such as omitting to inspect and maintain the arrangements for subdividing the air, &c.
10. Unknown.

Causes of ignition of the fire-damp:—

Naked lights	176
Matches	10
Opening of the safety lamp	58
Defects of the safety lamp	22
Heating of the gauze of the safety lamp ...	11
Passage of the flame of the safety lamp:	
Owing to careless handling	46
Too rapid an air current	8
Shot firing	94
Ventilation furnaces	1
Unknown...	11
Total number of fatal explosions	437

Statistics quoted by this Commission show no very considerable variation in the number of explosions in the different months, but in the winter, when the demand for coal is greatest, they are the most frequent. They display, moreover, a decided tendency to take place on Mondays, showing that the stoppage for the Sunday, favours the accumulation of fire-damp.

The detection of fire-damp is a matter of vital concern to all engaged in a coal mine. So much is this held to be the case, that recent researches have led to the making of safety lamps capable of detecting very small percentages of gas. It has been held that even less than one per cent. may be explosive in the presence of coal dust, and the lamps referred to estimate as little as one-half of one per cent. The ordinary method

adopted in mines is much less delicate than this, and will not detect less than 2 to 3 per cent. of fire-damp. The flame of a lamp is reduced until the luminosity almost disappears, and then the fire-damp appears as a pale flame or "cap" above it, this "cap" being due to the presence of gas in the air. The amount of gas present can be estimated by the dimensions of this cap. It will at once be understood, especially with this ordinary and less delicate test, how important it is that indications of the presence of gas should be at once recognised. The class of men in a mine who are responsible for seeing that the pit is free from dangerous quantities of gas are those called "deputies" or "firemen." It is part of their duty to visit the "workings" before the colliers go to their work, and during their "working shift," to ascertain whether or not "gas" in any amount is present. Throughout their regular day's work, moreover, they are on the look out for any accumulations of gas.

Mention has already been made of nystagmus as a disorder of the eyes to which miners are very liable, and the prominent symptom of which is that, to those afflicted, objects looked at appear to be moving, spinning round, often in a circle. Among those known to suffer from the affection are to be classed these "deputies" or firemen. Many instances have come before me. They have generally previously worked at the coal face. Now it has for long presented itself to my mind that a man afflicted in such a way that an ordinary safety lamp appeared to dance about, could hardly be regarded as a reliable tester for gas in which the proper and delicate perception of the faint cap which formed over the flame was a matter of so much importance. I not long ago discussed this subject in an article published in the *British Medical Journal*. To put my opinion to a practical test in the mine was not easy, but an opportunity presented itself, and a friend promised to observe the capacity of a "deputy" suffering from nystagmus for me in such a way that his attention would not be drawn to the fact that he was being tested. As we anticipated, he failed to recognise that gas was present until the flame had lengthened out; and tested again, and asked to speak when he saw the "cap" on my friend's lamp, he did not do so until the flame had begun to lengthen out. Other cases have shown me that this matter is one of considerable importance. On the discovery of the presence of fire-damp, the lives of perhaps the whole of the men underground are at stake. If a "deputy" has failed to detect its presence sufficiently promptly, he has paid the penalty and perished with the others. In my opinion this is a matter sufficiently momentous to bear in remembrance as being a possible explanation of the occurrence of some explosions, and

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such I may add is the opinion also of some mine experts who are acquainted with my observations on this subject. It is, besides this, important that the gas tester should have keen vision.

The increased importance which has in recent years been attached to coal dust as a factor in the causation of explosions, has led to the adoption in mines of explosives designated flameless. Dynamite and its allies, amongst others, have been used, but those containing benzol require brief consideration here. Only recently I placed on record my observations on the effect of di-nitro-benzol* upon the health and eyesight of those employed in the making of explosives, of which it formed an important constituent. The Home Secretary about this time was preparing to take some action, and after enquiry by Dr. Dupré and Commander H. Smith, one of the Inspectors of Factories, the manufacture of these articles was classed as "dangerous to health," and notice was served on the manufacturers to observe "special rules."

Miners from time to time, but not many times altogether, complained to me that the use of roburite, an explosive containing the di-nitro, was injurious. But in Lancashire and the North of England the complaints were of such a character that inquiries were held. Drs. Hannah and Mounsey, with Professor Harold Dixon, F.R.S., investigated the subject in Lancashire, and made a very valuable report. They were inclined to attribute to the improper handling of the cartridges the undoubted cases of nitro-benzol poisoning which had been brought under their notice. They insisted on the necessity of complete combustion, but thought that if stringent care was exercised by the managers, shot firers, and colliers, the use of roburite would not add to the harmful conditions under which the miner worked. In Durham, Drs. Drummond and Hume, with Professor Bedson, were appointed to deal with the matter, and their report is a complete one, in particular the experimental and chemical part, which was undertaken by Professor Bedson. A careful examination of the fumes in the mine after using these explosives was made, and the report says that, "in some cases, after firing the roburite, the odour of nitro-benzol was observed, but beyond this we obtained no evidence of nitro-benzol or any similar product." He further alludes to the danger resulting from the fumes being almost entirely gaseous, because their consequent invisibility may lead the miner to return to his work sooner than he would if, for instance, gunpowder was used. They thought, moreover,

* *British Medical Journal*, March 3, 1894.

that the particles of the benzol existed in too small quantities to be hurtful. My observations showed, I think, that the dinitro was a very subtle poison, and that among the workers with it, those apparently coming little into direct contact with the substance, either its vapour, or by handling the powder, still suffered by no means infrequently from serious constitutional symptoms. I have never had any serious effects brought to my own knowledge from the use of any explosive containing it in the mine. I should, however, recognise that under certain circumstances injurious effects may be occasioned, but should on the other hand equally hold that such effects are preventable, and would urge attention to, care in handling the cartridges, insuring perfect combustion, and by efficient ventilation affording ready escape of the fumes from the working places.

The review which I have been able to give of my subject will have shown that the miner's is a laborious and disagreeable occupation, pursued under peculiar conditions. Working underground, and thus shut off entirely from the light of day, the collier exercises his calling under like circumstances to many of the workers in metalliferous mines; but a striking difference is shown in the manner of his work, the constrained posture it requires, and above all in the atmospheric conditions, which expose him to dangers unknown to other miners. It will, however, have been observed that notwithstanding all the circumstances the miner ranks well in mortality tables, and that his occupation must be regarded as a healthy one. With the question of the limitation of the hours of labour we have here little concern. In passing, however, it may be remarked that the interference of the legislature has before now been evoked with good effect on behalf of those employed in industries which were recognised as detrimental to the health and well being of those engaged in them. It by no means follows, in the absence of these conditions, that no action should be taken, for there may be many other excellent reasons, economic and other, that render such a step desirable; and in the case of the collier no doubt such reasons are present to the minds of the advocates of a compulsory shortening of the hours of labour. It suffices for us to say, that a review of all the facts set forth in this lecture demonstrates that the miner's, compared with other occupations, is a healthy one; or to quote the words of the Labour Commission: "The weight of evidence seems to be against the idea that coal mining is an unhealthy occupation, even when allowance is made for the probability that weakly men either avoid or soon abandon it."

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QUARRYING.

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One of a course of five lectures on The Sanitation of Industries and Occupations.

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In the course of an hour it will be impossible to deal in an adequate fashion with such a subject as quarrying. I can merely hope to bring before you some of its salient features. I have arranged my remarks under the following heads:—

1. Definitions of a quarry.
2. Kinds of Minerals worked.
3. Processes of excavation.
4. Methods of arranging the workings.
5. Transport.
6. Preparation of the mineral for the market.
7. Accidents.
8. Diseases.
9. Laws affecting quarrying.

1.—DEFINITIONS OF A QUARRY.

At the very outset let me point out that it is by no means easy to define exactly what a quarry is. You will probably say that that is a somewhat strange prelude, when the lecturer candidly confesses that he cannot explain precisely what he is going to talk about; but I will tell you in a moment where the difficulty lies and why it is necessary to lay some stress upon this question of definition. "What is a quarry?" If I were to put this question to you most would reply without hesitation, "A quarry is a place where stone is dug." This is a good popular definition; the classical scholar might base his reply upon the origin of the word and say that it has come down to us from the Low Latin word "quadraria," meaning a place where squared stones were "got," the verb "quadrare" signifying "to make square." The "quadratarius" or "quarryman" was originally the stone-cutter who trimmed stones into shape for building purposes. It is easy to understand that the term quarry eventually denoted any excavation made for getting stone, whether dressed into cubical or parallelopipedal forms or sent into the market in irregular lumps.

When we come to look at the question from an official point of view, the popular explanation has to give way to strict definitions laid down by Acts of Parliament or ascertained by legal decisions.

In the first place many excavations, which are popularly known as "quarries" because stone is obtained from them, are legally "mines." We thus at once must make the distinction between—

1. Workings open to the sky.
2. Workings underground.

Judicial decisions have settled very clearly that in this country it is the nature of the excavation which determines whether any given workings are a "mine" or not. If the mineral is obtained by underground passages and chambers under a cover of rock, the workings are legally "mines."— Where stone is obtained, such workings are popularly known as "underground quarries," and they are more numerous than many persons think. About one-third of the slate of Wales and most of the Bath stone is nowadays quarried in underground chambers, that is to say, legally, it is "mined."

On the other hand, if we cross the Channel, a different state of things prevails. Workings for minerals in France are classified according to the nature of the substance, and not according to the nature of the excavation. If iron ore is being worked, the undertaking is designated a mine, even if it is merely a shallow pit open to daylight, whereas underground workings for stone, no matter their depth and complexity, enter into the category of "quarries."

This essential distinction between the laws of the two countries must be borne in mind in making international comparisons of death-rates from diseases or accidents.

Having pointed out that much stone is got by true mining operations, let me now turn to workings which are open to the sky. There are no less than three legal definitions of "quarries," which I will take according to the dates of the Statutes.

1. *Factory and Workshop Act, 1878* (41 Vict., Ch. 16), Fourth Schedule (25): Quarries, that is to say, any place not being a mine, in which persons work in getting slate, stone, coprolites, or other minerals."
2. *Quarry (Fencing) Act, 1887* (50 & 51 Vict., Ch. 19), Section 4 says: "The term 'Quarry' includes every pit or opening made for the purpose of getting stone, slate, lime, chalk, clay, gravel or sand, but not any natural opening."
3. *Quarries Act, 1894* (57 & 58 Vict., Ch. 42), Section 1 reads thus: "This Act shall apply to every place,

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not being a mine, in which persons work in getting slate, stone, coprolite, or other minerals, and any part of which is more than twenty feet deep."

It is not necessary for my purpose to-night to bind myself closely to any one of these definitions; I merely point them out to confirm my opening statement that it is not easy to state exactly what is meant by a "quarry" in the United Kingdom.

I think that it will be convenient, for the purposes of this lecture, to regard as quarries any underground workings for stone, and all other workings for minerals which are directly open to the sky, and which may conveniently be comprised under the term "open works."

2.—Kinds of Minerals worked.

The minerals we have to deal with are very varied, indeed it may be said that practically every kind of mineral has at the outset been got by open workings; and even at the present day very large quantities of metallic ores are obtained in that manner without any burrowing underground.

Among the minerals worked opencast, are: alumstone, asbestos, brick-earth, chalk, clay (including china-clay, fire-clay, fuller's-earth, potters'-clay), coal, and more especially brown coal, copper ore, gems, gold, gypsum, iron ore, iron pyrites, lead ore, nitrate of soda, phosphate of lime, stone of all descriptions, strontium sulphate, tin ore.

From a geological point of view the deposits worked are likewise very varied; sometimes they are stratified and have been formed by the deposition of sediment in old seas or rivers, by the growth and accumulation of animal or vegetable organisms, or by precipitation from solutions; in other cases we have to deal with rocks which were at one time in a fused or plastic condition, and which are said to be of igneous origin. In fact, any portion of the earth's crust which can be utilized in the arts or manufactures may be obtained by a quarrying process.

3.—Processes of Excavation.

With substances varying in nature from the loose sand to hard granite, it is evident that the processes employed in "getting" must be numerous. The excavation may be effected by manual labour or with the aid of machinery. The simplest hand tool is the crowbar. It is thrust into cracks and joints, and by using it as a lever blocks of stone are prized off. Next come the pick and shovel, familiar tools in almost all workings for minerals, differing more or less in form according to the

precise substance for which they are used. Wedges driven in by sledge-hammers may be called to the aid of the quarryman to detach his blocks of stone; and lastly we come to blasting operations, by which so much mineral is forcibly wrenched off from its bed.

The jumper, that is to say, a bar of iron steeled at the end and forged into a chisel-shaped "bit," is an implement frequently seen in open works for boring holes to receive the explosive; short holes are likewise made by striking a steel chisel (borer) with a steel hammer or sledge.

The powerful explosives, which owe their strength in the main to nitro-glycerine, such as dynamite, blasting gelatine and its congeners, though very largely used, have not yet displaced the old-fashioned gunpowder. The latter holds its own in many cases where the rock has to be wrenched off gently, so to say, and where the smashing action of the high explosives would more or less spoil the material which has to be extracted.

The excavating machines used in quarrying may be classified as follows:—

1. Diggers.
2. Dredgers.
3. Boring machines.
4. Groove cutters.

1. Steam diggers known sometimes in this country as "steam navvies," and in the United States as "steam shovels." Dunbar & Ruston's is shown in the figure (Fig. 1). It may be

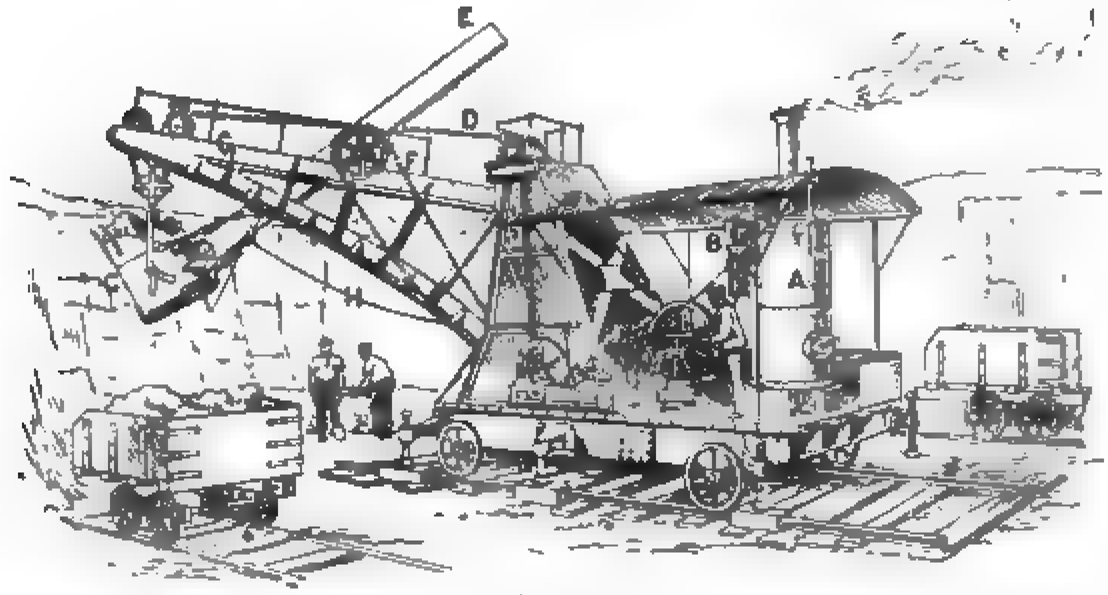

Fig. 1.*

A, vertical steam boiler; B, one of two steam cylinders; C, bucket or sc·op; D, chain for lowering the scoop; E, arm to which the scoop is attached; F, chain for turning a pinion which gears into a rack upon E, and can be made to alter the depth of the cut; H, cord for opening bottom of the scoop.

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* Figures 1 to 7 are taken from the Author's book upon "Ore and Stone Mining," by the kind permission of Messrs. Griffin & Co., the publishers.

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described as a huge toothed scoop at the end of an arm (E); it is drawn by steam power against the working face, and fills itself with 1 to 1½ cubic yards of mineral, which is discharged into a waggon by pulling a cord (H) which opens the hinged bottom.

These gigantic diggers are employed not only by railway and canal engineers, but also by quarry owners. Sometimes their business is simply to remove over-burden; in other cases they dig up the valuable mineral itself, such as iron ore or even auriferous gravel. In the Mesabi Range, Minnesota, iron ore is excavated in open workings and at once loaded into railway waggons by the steam shovel.

2. One naturally associates the dredge with workings under water, but in addition to being used for excavating gold-bearing sand and gravel from river bottoms, it may render useful services upon *terra firma*. A dry dredge with an endless chain of buckets is employed for stripping off a thick layer of gravel covering a bed of brown coal near Cologne, and Priestman's grab dredge might have been seen not long ago digging up brick earth in the vicinity of London.

3. Rock drills, that is to say, machines which bore holes for blasting, are at the present day rendering immense services to the quarryman. They relieve him from a toilsome labour, and ensure a rapidity of work which was previously unknown. An ordinary percussive rock-drill is merely a cylinder, with a piston driven backwards and forwards by steam or compressed air, and a cutting chisel attached to the piston rod. The chisel is therefore made to strike its blows mechanically with great force, and the number of shot holes which can be bored in a given time is very great.

4. Though rock suitable for many purposes can be obtained by ordinary blasting, this process is out of place when it is necessary to quarry such a material as marble. Blasting would get out irregular lumps and would shatter the rock, or at all events produce cracks, whilst the object of the worker is to obtain perfectly sound blocks of parallelopipedal form. Various groove-cutters are in use, which enable the quarryman to effect his purpose. An old machine, but one still largely used in the United States, is the Wardwell Channelling machine. It is an appliance in which steam power replaces manual labour in working jumpers. Three or five chisels are arranged side by side, and are lifted and dropped by a steam cylinder so as to chip out a vertical groove. Smaller machines have now been brought out by the Ingersoll and Sullivan Companies.

Instead of chipping out a long groove, it is sufficient in many cases to bore out a series of holes along a given line, and

then break down the intervening partitions with a special tool. Machines for this purpose are largely used in the United States.

A large circular saw mounted upon a suitable carriage which cuts vertical groves 30 inches deep is likewise of American construction. One of the most ingenious groove cutters is Wilmart's wire saw (Fig. 2) which has been employed with success at a Belgian marble quarry for upwards of ten years. Three iron or soft steel wires, each a quarter of an inch in diameter, are twisted into a strand and are made to form a long endless cord, A C D F, which is drawn by machinery over the surface of the rock K L, whilst sand and water are fed on to it continuously. The sharp grains of sand are caught in the interstices between the wires and as they are dragged along they cut the stone which lies in their path. Then pulleys which guide the wire

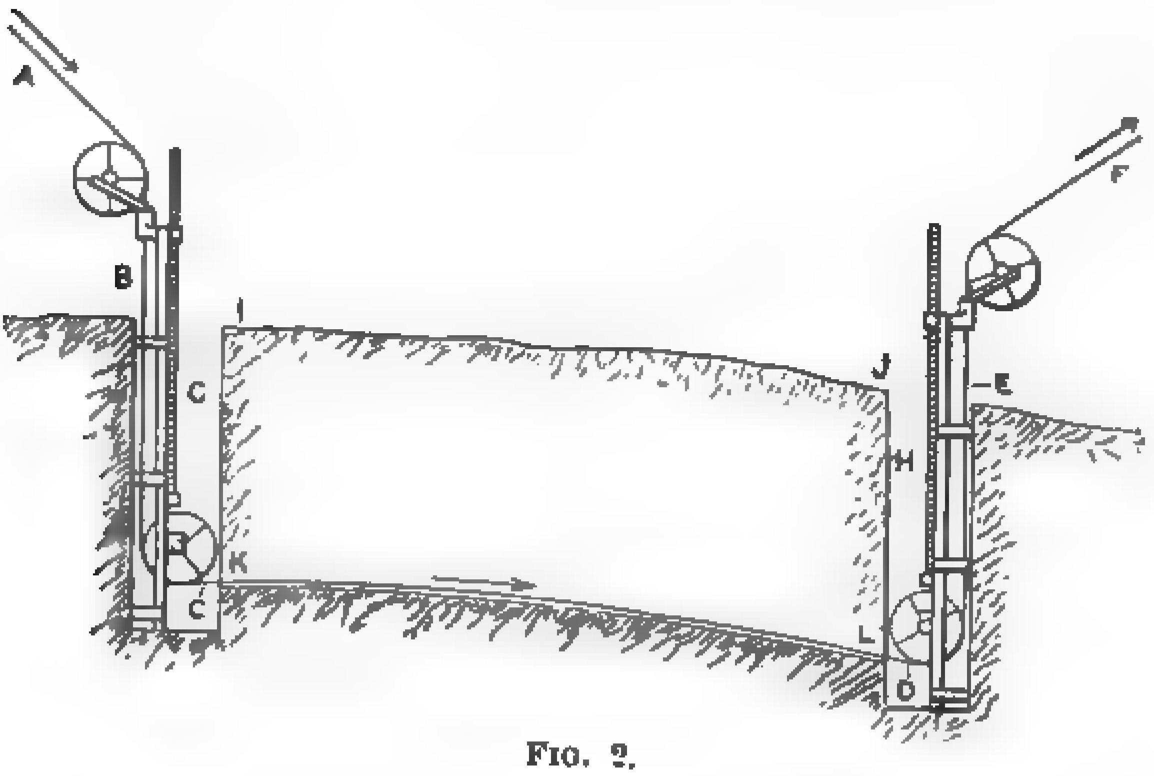

FIG. 2.

saw are fixed upon frames in little pits H G specially excavated for the purpose at each end of the cut, and are duly lowered as the work proceeds so as to keep the wire cord upon the bottom of the groove. Plates I. and II. (p. 136) show the vertical faces of rock left by the cuts of the wire saw, and in the centre of the former is a detached block of marble which is being sawn in half by one of the cords in the pit. When the cutting process began the wire would have been running along the line I J.

Two other special methods of excavation deserve mention, viz., processes depending upon the action of heat and upon the action of water.

It is probable that "fire-setting" is one of the oldest forms of mining and quarrying, and in spite of the discovery of the new and more powerful explosives it has not entirely died out.

The effect of the fire is to crack and split the rock and to render it easily removable by the pick, crowbar or wedge.

In the island of Naxos emery is quarried exclusively by fire-setting. A pile of brushwood is heaped up against the rock and lighted. When it has burnt out in about two or three hours, water is thrown upon the heated rock and the sudden chilling produces fractures which enable lumps of emery to be got out easily. Jade is quarried in Burmah, and stone in India in the same fashion.

Water serves a useful purpose for getting china clay in Cornwall and Devon. The granite in these counties is sometimes thoroughly decomposed, owing to the conversion of the felspar into kaolin. Where the existence of such a mass of suitably decomposed rock has been proved, the overburden is stripped off and a shaft sunk; its bottom is put into communication by a tunnel with another shaft, sunk in the adjacent hard granite and fitted with pumps. Water is led on to the soft decomposed granite which the workman loosens with a pick; the milky stream flowing away from the working face is led into a settling pit near the top of the first shaft, where it deposits coarse grains of quartz. It now drops down the shaft, runs along the tunnel, is pumped up to the surface and led away to settling pits.

The hydraulic mining of the United States is carried on by

FIG. 3.

playing upon banks of gold-bearing gravel with jets of water under considerable pressure. Vast works are undertaken to provide adequate supplies of water, which is stored in high reservoirs, created by artificial dams, and then led for miles by ditches to the points where it is required. Valleys are crossed by iron pipes or by troughs carried by trestles.

The huge jet of water issuing from a nozzle under the control of a workman is directed against some part of the gravel bank and made to undermine it (Fig. 3). Great masses fall and are disintegrated by the spouting water; the result is a muddy stream, which flows away hurrying along with it sand, gravel and boulders, and all the gold. It is conducted into long lengths of wooden troughs, specially arranged for catching the gold by the aid of quicksilver.

These two processes by fire and by water are exceptional. I now proceed to say a few words about the ordinary methods of arranging the quarry workings.

4.—Methods of Arranging the Workings.

As already stated, the mineral may be quarried in two ways:

1. By pits open to the sky.
2. By underground mining.

The shape assumed by the actual excavation must depend greatly upon the nature of the mineral and its solidity. Hard solid rock, like limestone or granite, may be allowed to stand up in high and almost vertical faces, whereas less stable materials, such as clay and sand, would slip in or run in if one tried to treat them in like manner.

A very simple process of working is that adopted in Chili for obtaining nitrate of soda. The impure nitrate (*caliche*) is found in beds from six inches to twelve feet thick beneath a covering of hard conglomerate (*costra*) from one to ten feet thick. A small shaft is sunk a little below the bottom of the *caliche*, and enlarged in order to receive a charge of slow-burning powder made on the works. The explosion loosens and breaks up the ground over an area about twenty yards in diameter. The hard overlying stratum of *costra* is then easily removed, and the *caliche* is broken up into lumps, which are taken to the lixivating and crystallising works.

Working in steps, stopes, terraces, benches, lifts, or galleries, for all the terms are used, may be looked upon as the typical method of quarrying, and we may find examples in the case of many kinds of ores and stones.

Fig. 4 shows part of the great *opencast* at Rio Tinto, a huge open pit from which cupriferous iron pyrites is quarried in steps

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or terraces 33 feet to 50 feet high. Only the middle of the pit is worked for ore; the upper terraces are cut out in barren surrounding rocks, which have to be removed in like manner in order to prevent disastrous and dangerous falls of the sides.

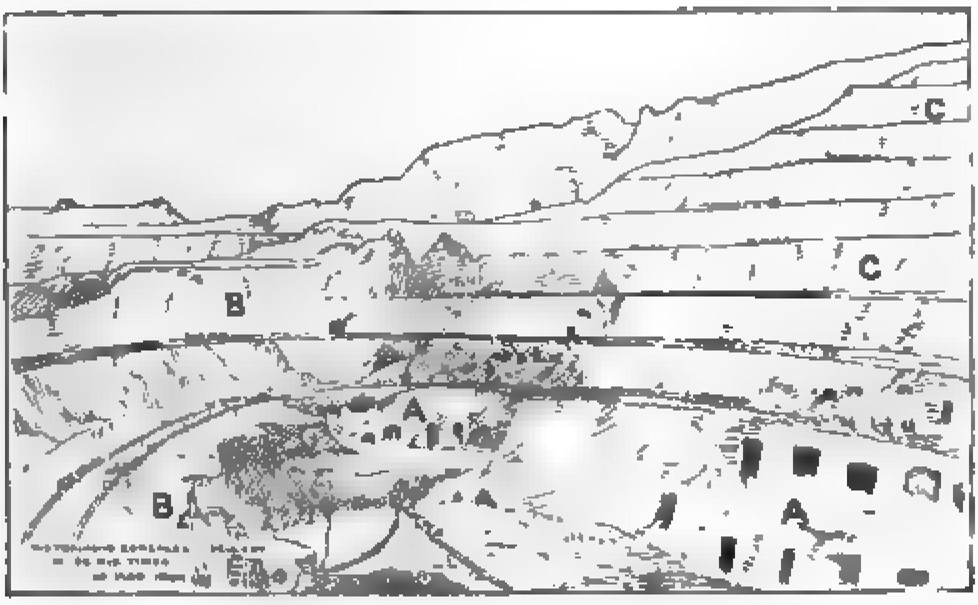

FIG. 4.

A, cupreous pyrites; B, slate; C, porhyry.

The great Penrhyn slate quarry near Bangor is well-known to all tourists in North Wales (Plate III) p. 136. The valuable slate and the valueless overburden are both taken away by a series of terraces on an average 60 feet high by 30 feet wide.

The lead-bearing sandstone of Mechernich was at one time worked opencast on a very extensive scale. At the present time the underground workings are of more importance.

The famous iron ore of Styria is mainly worked opencast, or to use what is now the legal expression in this country, is "quarried." There are in all nearly fifty terraces, in fact the workings may be looked upon as a gigantic flight of stairs 1,500 feet high, the tread of each step being on an average 36 feet. These workings in Styria produced in 1891, about three-quarters of a million tons of iron ore.

If the rock is firm enough to stand alone for a great height, it is sometimes taken down in one vertical slice, without making a series of steps. The general appearance of Mulberry tin mine near Bodmin in Cornwall is shown in Fig. 5. Men standing at A bore and blast holes which throw the rock to B, under which a tunnel has been driven with an opening C, usually covered with timber. A waggon is then run in and is quickly and cheaply filled.

Much chalk is quarried, in the neighbourhood of Rochester for instance, in a somewhat similar fashion.

A last method of quarrying is by gigantic blasts, which bring down thousands of tons of stone at a time. It is practised in some limestone quarries in this country, both in North Wales

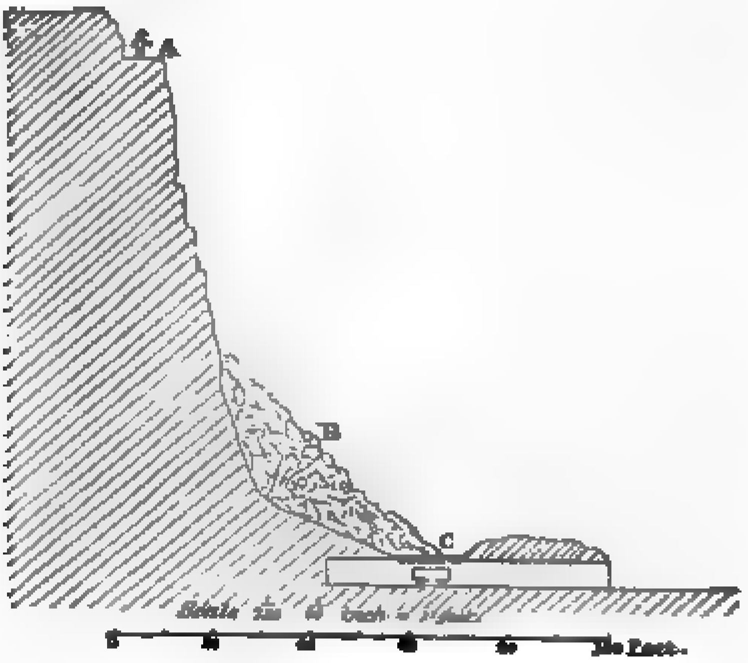

FIG. 5.

and in Derbyshire. A tunnel is driven in to the face of the quarry, and a chamber is excavated for the reception of explosives. The tunnel is now filled up with earth, or masonry, or both, and the charge is fired by a long fuse, or by electricity. The result is the displacement of thousands of tons of rock, the clearing away of which may occupy the quarrymen many months.

Fig. 6 explains how this process was applied in quarrying

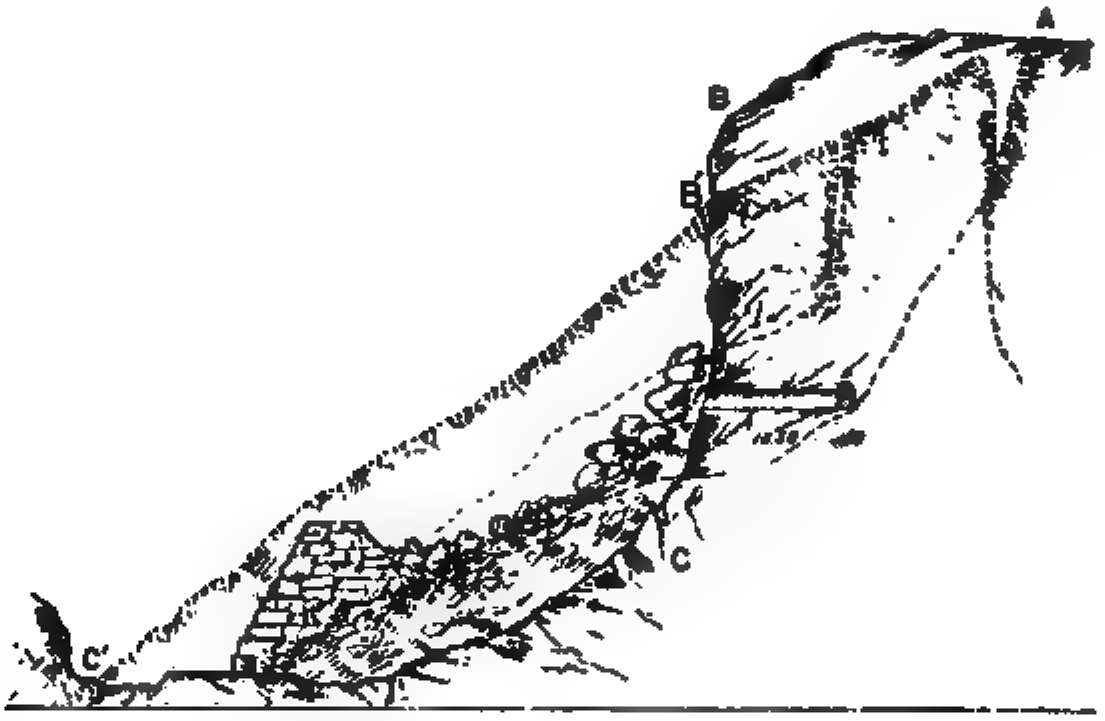

FIG. 6.

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limestone near Messina; a charge of 31 cwt. of powder in bags was placed in a special chamber at the end of the tunnel, driven into the face of the quarry, and the tunnel having been duly tamped, the powder was fired, bringing down no less than 100,000 cubic yards of rock. A B C shows the original outline of the face of the quarry, the dotted line A B′ C′ gives the outline after the explosion. Granite has been quarried at Baveno on the Lago Maggiore in a like manner. In 1886 a monster blast of 17½ tons of gunpowder and half a ton of Nobel's dynamite were exploded simultaneously, displacing 500,000 cubic yards of granite.* Twenty or thirty blocks of from 1,000 to 6,500 cubic yards each were carried fully 300 yards by the explosion. A block of 6,500 yards would be represented by a cube of 55 feet on the side.

As will be naturally understood, the task of removing waste rock or earth often lying above the useful mineral increases with the thickness, until at last a point is reached, when it will no longer pay to work the quarry open. The quarry owner then endeavours to devise some method of excavating the valuable material by itself, leaving the waste rock as a roof. This leads him to true underground mining, which, from a strictly legal point of view, is beyond the scope of my lecture. However, when stone is obtained from such excavations, they are popularly known as quarries, and on this account they deserve a word of mention.

As the material quarried is usually of small intrinsic value, the cheapest method of supporting the roof is to leave portions of the deposit unworked. This method is employed in working slate at Festiniog in Merionethshire. The beds of slate are sometimes more than 120 feet thick, and are worked by chambers separated one from the other by thick partitions of rock; in other words, a huge wall of slate, 30 or 40 feet thick, is left standing between every two chambers of like dimensions. Two or three beds may be worked one above the other, care being taken that the position of the pillars shall coincide. The chambers themselves are huge caverns, the roof of which may be more than 100 feet above the heads of the workmen.

Wales is not the only part of the world where slate is obtained in underground quarries. France and Germany afford examples of similar, or somewhat similar, workings. At the slate quarries near Fumay on the Meuse, and Rimogne, near Mézières-Charleville, the men fill up the chambers with rubbish, and stand upon it while at work. (Plate IV., p. 136.)

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* *Chambers' Journal.*

5.—Transport.

A word must be said about the methods of bringing the product of the quarry from the workings to the places where it is made fit for sale.

These methods vary very considerably according to the situation and size of the workings. In some places, as already mentioned, the mineral is loaded in the quarry directly into railway trucks and sent away without any preliminary treatment whatever; in others it is lowered down the sloping sides of mountains or raised from deep pits. At the celebrated Carrara quarries blocks weighing from ten to forty tons each are lowered in a very primitive fashion down rough inclined planes by means of ropes twisted round posts, which are set up at regular intervals. The usual method is to construct self-acting inclines, the weight of the descending loaded wagons drawing up the empties.

When the quarry is a pit which cannot be tapped by a tunnel, the mineral may be drawn up inclined planes by any available source of power, or it may be lifted by a crane or an aerial incline. This latter device is largely used in North Wales and in Scotland, where it is known as the "Blondin" (Plate V., p. 136). It has the advantage of being easily and cheaply erected, and of being capable of picking up the load of mineral at various parts of the bottom of the pit. Fig. 7 will explain how it works. A strong cable (A D) is fixed across the top of the pit, and a cradle (E) with two grooved pulleys runs upon it. The cradle has a wire rope (F) attached to it, by means of which it can be lowered along the cable so as to take up any position upon it. A second rope (I) passes from the winding drum to a large pulley (H) hanging from the cradle, and then makes its way down to a second large pulley (K) to which is attached an iron box for carrying the load. If the cradle-rope (F) is stopped and the load-rope (I) let out, the lower pulley (K) descends with its box (L) to the bottom of the quarry. This is filled and the load-rope (I) is wound up again. The load ascends, but when the moving pulley (K) approaches its neighbour (H), the cradle-rope (F) is wound up at precisely the same speed as (I), consequently the hanging load is drawn along the line of the cable, and is landed at any convenient place (M) near the edge of the pit.

6.—Preparation of the Mineral for the Market.

As a rule the mineral coming away from the quarry requires treatment of some kind before it is brought into a condition fit for the purchaser. Considering the variety of substances

PLATE I.

Traigneaux Marble Quarry, near Philippeville, Belgium. The object of this photograph is to show the

PLATE II.

PLATE V.

Kemnay Granite Quarry, Aberdeenshire. The picture shows the "Blondin" raising a load of stone, the steam crane at the bottom of the pit for shifting blocks before and after they have been dressed, and the steps for the descent and ascent of the workmen

Photographed by WILSON, of Aberdeen.

[redacted]

PLATE VI

Sett-makers at work, Granite Quarry, near Aberdeen.

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which are quarried, viz., metallic ores, gems, and all kinds of stones, it would be impossible for me in the limits of this lecture

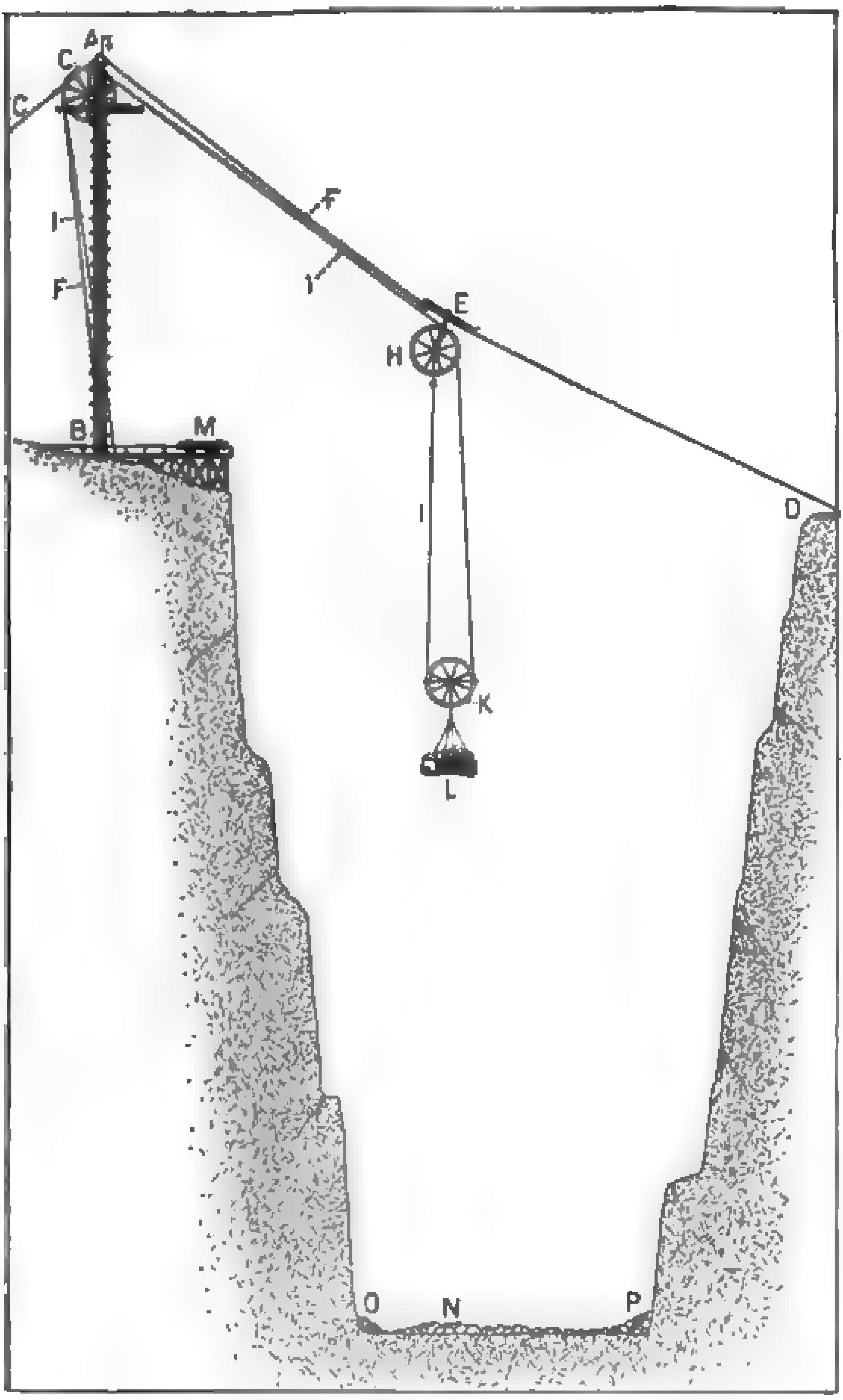

FIG. 7.

even to hurry through all the processes which are in use. The great subject of "dressing" could not be dealt with properly in less than a dozen lectures. I shall therefore limit myself to mentioning a few of the purely mechanical processes employed in the case of stone.

One important branch of the preparation of stone for the market is the manufacture of "setts" or paving stones. Plate VI., p. 136, shows how the Scotch workman, sitting down at his work, by dexterous blows of a hammer, which has a slightly concave face, splits the blocks across so as to form the paving stones he requires. The Carnarvonshire man stands and does his work in a bent posture.

The manufacture of road-metal is carried on, on an enormous scale in the Charnwood Forest district of Leicestershire, and likewise at Penmaenmawr in North Wales. The blocks of stone coming from the quarry are first reduced in size by a stonebreaker, that is to say, a machine with two huge jaws, which crack the stone just as we should a nut with the teeth; the broken stone then falls between two revolving toothed rolls; the stone is once more cracked and has simply to be passed through sieves in order to be separated into the different sizes required for various trade purposes.

In the case of slate, the blocks coming from the quarry, sometimes weighing a ton or two, are split by wedges into slabs about 3 inches thick, which are sawn across into the lengths required and then skilfully split by thin chisels. The thin sheets are "dressed" into the well-known rectangular shape, either by hand choppers or knives worked mechanically.

7.—Accidents.

Quarrying is usually reckoned as a dangerous occupation, and no doubt, as a rule, it may be fairly spoken of as such. But what is to be our standard of a dangerous occupation? Speaking roughly, I think an occupation may be called dangerous when on an average one person per 1,000 employed is killed annually by accident. At the present moment we have no figures by which we can ascertain the death-rates at quarries in the United Kingdom generally, such as are published annually in the case of mines; but a few statistics for special counties and quarries were prepared for the report of the Departmental Committee, which sat last year to enquire into quarrying and its dangers. This report showed that in working the open slate quarries of Carnarvonshire, the average annual death-rate from accidents for the ten years 1883 to 1892 was 1·53 per 1000 persons employed; it also showed that

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the two largest quarries, viz., Penrhyn near Bangor, and the Dinorwic near Llanberis, had the unusually low death-rates of 0·76 and 0·71 per 1,000 for the same period. Some of the others had a very heavy death-roll of 2 to 3 per 1,000, and even more.

The accidents happen in various ways: stones fall on to the workmen unexpectedly, or in other cases pieces of rock which are being brought down by the workman slide or roll in an unexpected manner, and catch the unfortunate man when he thinks that there is no danger. Blasting accounts for many casualties: shots go off while they are being rammed; fuses hang fire, and the charge explodes when the man returns to see what is amiss; men are struck from not retiring to safe shelters.

The death-rate of the underground slate quarries of Merionethshire is somewhat higher than that of the open quarries of Carnarvonshire, viz., 1·93 for the nineteen years, 1875 to 1893. This is not surprising considering the danger due to unexpected falls of rock from the roof or sides of the huge caverns in which the men work.

It is interesting to compare quarrying with other occupations, such as engineering works, railways, and shipping.

I scarcely think it likely that the death-rate from accidents of the Carnarvonshire slate quarriers will be greatly exceeded in any large districts, when figures are taken over a period of at least ten years. I base this statement upon the fact that 1·3 per 1000 is the rate for the stone quarries in Carnarvonshire for the ten years 1883 to 1892, and that a four years' average at Mountsorrel, in Leicestershire, gives 1·6. For our purpose we may assume that a death-rate of 1·5 per 1000 persons employed in and about quarries is somewhere near the mark.

According to official or authoritative statistics we get the following figures:—

Quarrying.	Years.	Average Ann. Death-rate per 1000 persons employed.
Open slate quarries in Carnarvonshire	1883—1892	1·53
Penrhyn slate quarry, nr. Bangor	,, ,,	0·76
Dinorwic slate quarry, nr. Llanberis	,, ,,	0·71
Open slate quarries in Carnarvonshire, omitting Dinorwic and Penrhyn	,, ,,	2·82
Stone quarries, Carnarvonshire	,, ,,	1·30
Mountsorrel stone quarries, Leicestershire	1890—1894	1·67

Mining.	Years.	Average Ann. Death-rate per 1000 persons employed.
All persons employed at the mines under the Coal Mines Act above and below ground	1873—1882	2·24
Ditto. ditto	1883—1892	1·81
All persons employed at the mines under the Metalliferous Act above and below ground	1873—1882	1·62
Ditto ditto	1883—1892	1·44
Engineering Works.		
Construction of the Manchester Ship Canal	1887—1892	2·48
Construction of Tower Bridge. London	1886—1894	2·90
Railways.		
All the Railway servants of the United Kingdom (accidents in which the movement of vehicles was concerned)	1870, 1873, 1877 & 1880—1892	1·48
Shipping.		
Crews of British Merchant ships	1871—1880	13·45
Ditto ditto ...	1881—1890	11·04

8.—Diseases.

It is scarcely wise on the part of a layman to discourse upon the diseases to which the quarryman is specially liable ; and even the medical man will have some difficulty in formulating any broad statements about quarrymen generally, whether as regards accidents. How can we compare, for instance, the workman in the shallow brick-earth pits in Kent, digging a soft material which crumbles in its fall and rejoicing in comparatively dry climate, with the worker upon mountain sides in Wales exposed to mist and rain, and threatened by the fall of huge rocks. The latter is liable to diseases brought on by damp, and to accidents caused by the depth of the excavation and nature of the materials handled by him. Both the English brick-earth digger and the Welsh slate-getter are legally workers in quarries, and yet the conditions of their labour are most dissimilar. Again, it is most difficult, if not impossible, to eliminate the effect of

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original fitness for the employment. It has been well shown and pointed out by Dr. Ogle that the weaklings of a family do not choose such an occupation as quarrying. Therefore, if in any given case the quarrymen show a lower death-rate from disease than the average inhabitants of the district, it by no means follows that quarrying is a healthy occupation; the quarryman may have a longer life than his neighbours, because he started less heavily handicapped in life's race by his constitution. On the other hand, if we find the quarryman dying earlier than his neighbours, we may safely assume that there is something in the occupation or its surroundings which shortens life, because otherwise we should not find those who started life with the best show of health, and the best prospect of longevity, giving way to those who originally had no expectation of winning the race.

Dr. Ogle's conclusions refer to stone and slate quarriers, or rather to the average of a certain number whom he has chosen from various parts of the Kingdom as examples. He undoubtedly finds a high comparative mortality figure; but after all it is precisely the same as that of the medical man. He attributes the high mortality in part to the accidents, and in part to diseases of the respiratory organs caused by the inhalation of dust. I do not think that the last word has been spoken upon this subject, and as regards Wales I prefer holding my hand until further investigations have been made. I believe that there is a wide scope for the Medical Officers of Health to investigate the healthiness or unhealthiness of the principal occupations of their respective districts. When this has been done in the case of quarrying, we shall have better data for forming opinions than exist at present.

9.—Laws affecting Quarries.

A word in conclusion respecting the laws which affect quarries. The subject may be rather a dry one, but it is well that the rudiments of it should be understood by all who are about to study any future statistics relating to the subject. Something has already been said on the matter when discussing the definition of quarries. I then mentioned that an Act had been passed this year called the Quarries Act, which comes into force upon the first of January, 1895. All workings any part of which is more than 20 feet deep will be transferred from the Factory Department, and placed under the Inspectors of Mines, who will at the same time have the powers of Inspectors of Factories, and whose business it will be to carry out the provisions of the Factory and Workshop Acts, and of Special Rules

framed under the Quarries Act. We shall, therefore, after the 1st of January, 1895, have no fewer than three different kinds of quarries in the Kingdom.

1. Open quarries less than 20 feet deep, retained under the Inspectors of Factories.

2. Open quarries more than 20 feet deep, placed under the Inspectors of Mines.

3. Underground quarries, which are legally mines and are subject to the Mines Regulation Acts.

Conclusion.

One of my principal objects in this lecture has been to explain by actual examples the many-sidedness of the subject of quarrying, and to point out some of the pitfalls which may beset the enquirer, who is not aware what the term "quarry" includes. Another point is that I should prefer to wait a few years before dogmatizing too much about the accidents or diseases. I think that there is still much work to be done before we arrive at a full knowledge of the good and evil of the quarryman's occupation.

REVIEWS OF BOOKS.

"IS SEWER AIR A SOURCE OF DISEASE?"

Two reports have recently been presented to the Main Drainage Committee of the London County Council,* which deserve the serious consideration of those engaged in sanitary work or public health administration. In the first series of experiments sewer air was examined as to the amount of carbonic acid gas, and the numbers of micro-organisms contained in it. In the second series, undertaken conjointly by Mr. Parry Laws and Dr. Andrewes, the relationship between the micro-organisms of sewage and those of sewer air was made the subject of study, and special observations were made on the presence or absence of the bacillus of typhoid fever in sewage. It will be necessary to describe shortly the methods pursued in these investigations, and their results.

In the first series, the sewer chosen for experiment was that known as the King's Scholars' Pond sewer, which runs in a straight line under the Green Park, from Piccadilly in the north to Buckingham Palace Road in the south. It is barrel-shaped, being 11 feet high and 9 feet wide; and its length is 300 yards. It is ventilated by open gratings in the crown of the sewer, placed in the turf at distances of about 50 yards apart. This sewer was constructed some 120 years ago.

There are two entrances to the sewer, one close to Piccadilly and the other about 200 yards further south in Green Park. A wooden staging was erected across the sewer a few feet from this second entrance, by which Mr. Laws gained access to the sewer. The staging supported the apparatus for the collection of the samples. No lateral sewers or house drains enter the King's Scholars' Pond Sewer from one end to the other, and the air which gained access to the sewer had a distance of from 40 to 60 yards to travel either way before reaching the staging.

Eight experiments were made extending over a period from August 14th, 1891, to October 27th, 1891. The carbonic acid of the sewer air was found to vary from 4·40 as a minimum to 16·04 vols. as a maximum per 10,000 vols. of air, giving an average for eight estimations of 9·18 vols. per 10,000, the carbonic acid of the outer air varying during the same period from 2·54 as a minimum to 3·18 as a maximum per 10,000 vols. In five out of seven determinations the number of micro-organisms in sewer air was less than in the outer air, in the other two cases greater than in the outer air, but the excess was due almost entirely to moulds and not to bacteria. A

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* Report on Sewer Air Investigations, by J. Parry Laws, F.I.C., 7th Dec., 1893. Report on the Result of Investigations of the Micro-organisms of Sewage, by J. Parry Laws, F.I.C., and F. W. Andrewes, M.B., M.R.C.P., D.P.H., 13th Dec., 1894.

decrease in the number of micro-organisms in fresh air was followed by a decrease in the number of micro-organisms in the sewer air. The average number of micro-organisms in 10 litres of outer air was 52, 31 being moulds and 21 bacteria. The average number of micro-organisms in sewer air was 61, 51 being moulds and 10 bacteria.

Certain experiments were also made to determine the effects of splashing of the sewage on the micro-organisms in sewer air. The splashing was effected by continuously filling (with sewage) shoots placed at about the middle line of the sewer and at varying distances from the apparatus, the object being to imitate and estimate, as nearly as possible, the disturbing effect of a house drain delivering into a sewer, but without violent splashing. Previous experimenters had shown that if the splashing is sufficiently violent to produce a very fine state of division of the sewage, organisms will be carried some distance in the sewer air, even 50 to 60 yards. Mr. Laws' experiments as conducted, however, demonstrate that a moderate degree of splashing produces practically no effect upon the number of micro-organisms in the sewer air.

Mr. Parry Laws' conclusions from these experiments are as follows:—"(I.) The micro-organisms in the sewer air are related to the micro-organisms in the air outside, and not to the micro-organisms of the sewage. (II.) In the air, both within and without the sewer, the forms of micro-organisms present are almost exclusively moulds and micrococci; the micro-organisms of sewage, on the contrary, are for the most part bacilli. Of the latter sometimes as many as 25 per cent. very rapidly liquefy the gelatine on which they grow, whereas in the whole course of my experiments with fresh air and sewer air I only met with one colony, and that a micrococcus, rapidly liquefying gelatine. The whole of my results point unmistakably to the conclusion that the principal, if not the only, source of micro-organisms in sewer air is the air without the sewer, and not the sewage; and they also tend to prove that there is very little ground for supposing that the micro-organisms of sewage, *in the absence of violent splashing*, become disseminated in the sewer air."

Subsequent experiments (second Report) were undertaken to ascertain (1) whether an increase in the velocity of the air current in a sewer, beyond the limits met with under ordinary conditions, would produce a concomitant increase in the number of micro-organisms.

Observations were made in the air shaft erected at Pimlico pumping station with the object of ventilating the low level sewer. Through the ventilating shaft, which feeds the boiler furnaces and has a diameter of 2 feet, sewer air is drawn at a speed varying from 5 to 11 feet per second, according to the condition and number of fires in use.

The average number of organisms present in 10 litres of this sewer air (five determinations) was 21, of which 5 were moulds and 16 bacteria. The average number of organisms present in 10 litres of outer air (three determinations) was 30, of which 19 were moulds, and 11 bacteria. "The results," writes Mr. Laws, "conclusively

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show that a considerable increase in the velocity of the air current does not produce an increase in the number of micro-organisms found in the sewer air."

(2). An experimental 9-inch sewer, 80 feet long, was laid in a suitable position in the pump-room at Pimlico Station, and investigations were undertaken to ascertain if the conclusions arrived at from the experiments in large sewers (such as the King's Scholars' Pond Sewer) hold good for small sewers when the flow of sewage is intermittent, and the velocity of the air current variable. Arrangements were made by which the 9-inch pipe sewer could be filled and emptied of sewage as desired, and for causing a current of air to traverse the pipe, the maximum velocity obtainable being 15 feet per second. Nine experiments altogether were made upon the air of this pipe sewer when emptied of sewage, and traversed by a current of air moving at the rate of 5 to 15 feet per second. The length of time during which the pipe remained full of sewage varied from 18 to 29 hours, and the time that was allowed to elapse between the emptying of the sewer and the collection of the air samples for examination, varied from 24 hours to 12 days.

The average number of organisms in 10 litres of pipe-sewer air was 34, of which 19 were moulds and 15 bacteria. The average number of organisms in 10 litres of the air of the pump-room, in which the 9-inch pipe was situate, was 33, of which 17 were moulds and 16 bacteria. These results show that practically no micro-organisms are given off from the walls of a pipe-sewer which has been empty, and open to the air at both ends, even for so lengthened a period as 12 days; and they are remarkable when we understand that sewage, with which the pipe had been continually filled, would contain some three to four million micro-organisms per cubic centimetre, and that immense numbers of these microbes must have been clinging to the internal walls of the pipe.

(3). Experiment was next made to ascertain what influence, if any, stagnant and highly putrescent sewage has upon the number of micro-organisms in sewer air.

The same 9-inch pipe-sewer was used, and was made to hold stagnant sewage by means of a dam occupying two-thirds of the sectional area of the pipe. The pipe was filled with sewage on August 21st, 1893, both ends of the pipe being kept open to the air. On August 30th and September 1st solid sewage sludge was placed in the pipe, and the open ends closed on the latter day. The air of the pipe over the stagnant sewage was examined on August 22nd, 24th, and 28th, September 1st and 22nd, and October 5th (six determinations).

Contrary to what might be expected the number of micro-organisms in the sewer air was greatest on August 24th. In 10 litres of sewer air, on that day, there were 123·5 microbes, of which 86 were moulds, and 37·5 bacteria, The air of the pump-room on this day contained 78 microbes per 10 litres, 47 being moulds, and 31 bacteria. On September 22nd—or three weeks after the addition of sludge, and the closure of the ends of the pipe—there were only 14·5 microbes present

in the sewer air, 2 of which were moulds, and 12·5 bacteria; actually less than the air of the pump-room, which contained 40 microbes per 10 litres. Again, on October 5th there were only 19·5 microbes present in the sewer air, as against 15 in the air of the pump-room.

These results certainly tend to show, contrary to a generally received opinion, that putrefaction of organic matters in a liquid contained in a 9-inch pipe, does not disseminate microbes in the air superjacent to the liquid.

An observation confirmatory of the above results was also made on the air of a sewer in Fulham, 400 yards long, with an upper dead end, and containing a very large amount of deposit. This sewer was in a very filthy condition, and being practically without ventilation, its contained air was exceedingly offensive. The examination of the sewer air was made on September 6th, on a very warm day (temperature in shade outside sewer 82° F.; inside sewer 56°·5 F.), and although the CO_2 per 10,000 vols. of sewer air was 46·33—*i.e.*, ten times the normal amount of atmospheric air, the number of microbes in ten litres of the air was only 12·5, of which one was a mould and 11·5 were bacteria.

To confirm Mr. Parry Laws' contention that the micro-organisms of sewer air are related to those of the outer atmosphere, and are in fact derived from the outer air which gains access to the sewer by ventilating openings, it was necessary to conduct an investigation into the nature of the microbes present in sewage itself under varying conditions. This investigation was carried out by Mr. Laws and Dr. Andrewes in the year 1894, and samples of sewage were examined which were taken from the outlet sewer to St. Bartholomew's Hospital (fresh sewage); from the Fleet sewer in Farringdon Street, under Holborn Viaduct, which takes the sewage from the districts of Holborn and Smithfield; from the outfall sewer at Barking, which represents the sum total of all the sewage of London north of the Thames; and from the Crossness outfall sewer, which is a similar summation of all sewage south of the Thames.

The total number of micro-organisms present in one cubic centimetre of sewage appears to vary very largely according to the freshness or putridity of the sewage, the temperature, and the dilution with clean water or rainfall. Somewhere between two and seven millions per cubic centimetre appear to be the limits, from the observations made.

Of more importance is the nature of the micro-organisms found in sewage, and their relations to those found in sewer air. The differences between the microbes of London sewage and those found in the air of London sewers may be stated as follows:—(1). Moulds are only very exceptionally present in sewage. In sewer air, on the contrary, moulds are the predominating feature, forming on an average some 64 per cent. of the total colonies present. The proportion, however, varies according to season; in winter it may be as low as 13 per cent., and in summer as high as 82 per cent.

(2). Bacillus coli communis—a normal inhabitant of the bowels of men and animals, and a predominant organism in sewage, being

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sometimes present to the extent of 200,000 colonies per cubic centimetre—has never been found in sewer air. Nor have the numerous allies of bacillus coli communis, which in most instances even outnumber the latter bacillus in sewage. Sarcina lutea, on the contrary, an organism very common in sewer air and fresh air, has never been isolated from sewage.

(3). The bacteria of sewer air consist mainly of micrococci; bacilli forming but a small proportion of the total species found. In sewage, however, bacilli greatly preponderate over micrococci.

(4). A large proportion of the bacteria of sewage have the property of very rapidly liquefying the nutrient gelatine used as a cultural medium. In sewer air, on the contrary, organisms rapidly liquefying gelatine are found to be practically absent.

(5). The number of micro-organisms existing in sewer air appears to be entirely dependent upon the number of micro-organisms existing in the outer atmosphere at the same time and in the same vicinity. As warm weather gives place to colder weather, and the number of microbes in fresh air rapidly decreases, a corresponding decrease in the number of microbes in sewer air is noticed, although the temperature of the sewer air and sewage suffer but a comparatively slight variation.

In the face of these results it seems impossible to do otherwise than accept Mr. Parry Laws' and Dr. Andrewes' conclusions that, under the conditions which controlled their investigations, there was no relationship between the organisms of sewer air and those of sewage, and that the source of the former was the fresh air gaining access to the sewer by ventilating openings, and not the sewage or the sewer walls with which the sewage is at times in contact.

From such a premiss, however, it would not be safe to reason that sewer air never contains injurious matters, and cannot, therefore, constitute any source of danger or injury to health.

In the first place it is clearly impossible that Mr. Laws' experiments could take account of all the varied conditions to which sewage may be subjected in sewers. We know that at times steam, and large quantities of waste water at a high temperature, may be injected into sewers from manufactories. Various chemical waste products also, acid or alkaline, occasionally find their way into sewers, and may there set up chemical decomposition in the sewage, and tributary sewers frequently discharge their contents into main sewers so as to cause much splashing and agitation of the sewage. The local effects produced by these various conditions—and by others which will suggest themselves to the minds of those familiar with sewers—must be investigated at length, before it is possible to assert that at no times, and on no occasions, are the micro-organisms characteristic of sewage to be found in the air of sewers.

Granting, however, for the moment that such an assertion is correct, even then it by no means follows that sewer air is innocuous and powerless to affect human beings injuriously. Mr. Laws himself recognises this when he writes: "It is impossible to ignore the evidence, though it be only circumstantial, that sewer air in some

instances has had some causal relation to zymotic disease. . . .

"It is quite conceivable," says Mr. Laws, "though at present no evidence is forthcoming, that the danger of sewer air causing disease is an indirect one; it may contain some highly poisonous chemical substance, possibly of an alkaloidal nature, which, though present in but minute quantities, may nevertheless produce, in conjunction with the large excess of carbonic acid, a profound effect upon the general vitality."

Here is a field for future research, which it is evidently desirable should be occupied without delay, and we trust that Mr. Laws and his colleague Dr. Andrewes may be enabled to continue their valuable investigations in this direction.

There is also another matter for consideration, which although it does not bear directly on the subject of sewer air as such, has been alluded to by the authors, though they have been unable to do more up to the present than propound a theory on the subject. Subsoils which have become polluted with sewage may, they think, give off micro-organisms to the subsoil air when the upper margin of the polluted soil becomes sufficiently dry. There are no facts recorded to show that such dissemination of microbes into subsoil air does take place; but assuming that such occurrences are possible, and having regard to the frequency with which subsoil air in the vicinity of dwellings is drawn into their interiors, the authors believe that some of the ill-effects upon health ascribed to sewer air may have in reality been due to subsoil air derived from soil polluted by constant infiltration of excremental matter through a leaky drain.

In practice, of course, it is impossible to distinguish between the effects of polluted air arising from the ground under or around a house and air derived *directly* from defective drains, soil-pipes, and sewers. A mere laboratory experiment is perhaps inadequate to elucidate thoroughly so delicate a point, as it is impossible that any laboratory investigation could imitate sufficiently closely the circumstances and operations of nature on an extended scale; still an investigation, which determined definitely that it is possible for sewage microbes to be disseminated into the air from sewage-polluted soil, would have the effect of strengthening very considerably the author's main contention that the air derived directly from sewers, being ordinarily free from the microbes characteristic of sewage, does not constitute any source of danger to health.

If this point were proved, and it was only a question of defective house drainage acting as a cause of disease, it might be possible to admit that in a great many cases illness usually attributed to direct emanations from defective drains, was in reality due to the entrance of subsoil air polluted by sewage, inasmuch as leaky drains, permitting sewage to percolate into the subsoil, are one of the commonest features of defective house sanitation. But it is impossible to narrow the question down to one of domestic sanitation. Skilled observers have attributed outbreaks of disease to improper or insufficient ventilation of public sewers, and to the escape of sewer air into houses.

Sir George (then Dr.) Buchanan in his Report on an Epidemic of

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Enteric Fever in Croydon in 1875 (Appendix to Report M.O.P.C. and L.G.B., New Series, No. VII.) wrote:—

"Where sewers are small and ill ventilated, they constitute perfectly sufficient means for the rapid distribution of fever infection; and places having such sewers may not only show fever rates maintained as high as before the sewers were made, but they may show as smart outbursts of fever as are witnessed where conveyance through water or milk is in question. Croydon itself, after it had made its sewers and before it attempted to ventilate them, had this experience. So in other instances that have come under my personal knowledge, fever has maintained itself after pipe-sewers, ill ventilated, had been laid; as in Rugby, in Carlisle, in Chelmsford, in Penzance, in Worthing; in the last two places breaking out in severe, sudden, and diffused epidemics, *without there being any question of other distribution than by sewers.*" (The italics are ours). With regard to the epidemic of enteric fever at Worthing in 1865, Buchanan wrote (9th Report, M.O.P.C.) that the absence of any provision for sewer ventilation, and the fact that sewer gases had been forced up into houses through the traps of sinks and water-closets, was the cause of the outbreak, of which a positive demonstration is afforded when it is added, "that the fever almost exclusively attacked well-to-do houses on the higher levels, where the water-closets were inside the houses, and almost entirely spared the houses, mostly of a much poorer sort, situated on lower levels, where the closet was put outside the house. It was not so in the times of cesspools; then, these low-lying poor houses were far more attacked with fever than the others. Moreover the fever subsided, as soon as openings were made into the sewers, from certain houses where it before maintained itself for months."

Besides these Croydon and Worthing epidemics may be mentioned an outbreak of enteric fever at Melton Mowbray, traced by Dr. Blaxall (Report M.O.L.G.B., 1881) to the occurrence of floods which backed up the sewage, specifically infected by typhoid evacuations, in the flat sewers. The air of the sewers entered the houses of the town through untrapped drain inlets and dry water-closet traps. Outbreaks of enteric fever at Sherborne in 1873 (Report M.O.P.C. & L.G.B., No. II., 1874) and in 1882 (Report M.O.L.G.B., 1882) were traced by Dr. Blaxall to contamination of the water in water mains by sewer air, there being direct communication between the water mains and the water-closets of houses. A similar state of things caused an outbreak of enteric fever at Caius College, Cambridge, in 1874, investigated by Dr. Buchanan (Report M.O.P.C. & L.G.B., No. II., 1874); and there was an epidemic at York in 1884, also traced by Dr. Airy for the Local Government Board to the exhalations from unventilated sewers.

Besides these classical examples, many other instances of outbreaks of enteric fever due to the eruption of sewer air into houses might be given, taken not only from the reports of the Medical Officers of the Local Government Board, but from the writings of Medical Officers of Health all over the country. Surely such positive evidence—circumstantial it is true, but still supported by the opinions

of the most skilled and experienced medical investigators—ought not to be set aside because certain negative evidence has been adduced that the air of sewers is remarkably free from the microbes present in sewage. Even apart from the admitted difficulty of proving a negative, the following considerations will show that in the present state of knowledge greater reliance ought to be placed upon the positive evidence than upon the negative demonstrations.

In the first place, bacteriological science does not at present permit of any dogmatic assertion that the microbes found in sewage are pathogenic organisms, capable of producing disease in man. The bacillus coli communis—the predominant organism of sewage and the common microbe inhabitating the bowels of men and animals—is not now believed to be a pathogenic organism or to be capable of developing pathogenic properties by cultivation in suitable media. Dr. Klein has clearly shown that although the bacillus coli is morphologically and culturally allied to the bacillus typhosus of Eberth and Gaffky—the microbe which is believed by many to be the cause of typhoid fever—yet the bacillus coli is altogether a distinct species, and that there has not appeared under the many and diverse conditions of laboratory experiments any evidence of transitional or intermediate forms between the one and the other species. (Journal of The Sanitary Institute, Vol. XV., Part III., p. 350.)

It may be taken then for granted that, so far as at present known, the bacillus coli, so commonly found in sewage, is under no circumstances a disease-producing organism, or capable of becoming such. And the same may be said of the other interesting organisms, such as the proteus cloacinus, the bacillus cloacæ fluorescens, the bacillus fluorescens stercoralis, &c., which have been isolated by Messrs. Laws and Andrewes from sewage, and which, if their nomenclature is correct, appear to be normal inhabitants of the bowels of man. The assumption of course is that organisms commonly found in the alimentary canal cannot be productive of harm, when re-introduced through the mouth and stomach, as they merely reinforce in numbers species already existing therein, the presence of which is perfectly compatible with health.

If, then, the microbes commonly present in sewage are accounted harmless, why should it be held that sewer air cannot be harmful because it does not contain these microbes? Surely this is an irrelevant conclusion. Those who adopt such a line of argument, however, rely upon the occasional presence in sewage of a particular organism —the bacillus typhosus,—and upon the undoubted fact that sewage specifically contaminated with typhoid fever evacuations, which has caused pollution of water supplies, has originated outbreaks of typhoid fever amongst the consumers of the water.

But here again there is no absolute certainty—nothing indeed stronger than a probability—that the bacillus typhosus is the *vera causa* of typhoid fever. Quoting again from Dr. Klein (*loc. cit.*), the bacillus typhosus is now admitted to be almost constantly present in the alimentary canal, in the mesenteric glands, and in the spleen of cases of typhoid fever, and is passed in large numbers from the

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body of the patient with the fæces. The organism is therefore constantly associated with the disease, but this constant association does not logically prove that the microbe is an indispensable antecedent (cause) of the disease, or even an antecedent (one of several causes in conjunction) of the disease, or indeed that it is anything more than a *consequence* of the disease. The chain of experimental proof necessary to completely establish the causal relationship of the organism so constantly associated with the disease is, indeed, wanting. The lower animals do not suffer from typhoid fever, consequently inoculation experiments on animals—absolutely necessary to establish the proof—are not available.

There are still other difficulties in the way of accepting the view that the bacillus typhosus is the actual cause of typhoid fever. The experiments conducted by Mr. Laws and Dr. Andrewes show that sewage is an unfavourable medium for the growth, and even for the continued existence of the bacillus typhosus. If the bacilli find an entrance into sewage they do not increase, but actually rapidly diminish in numbers, and at the end of a few days, or at most one or two weeks, there are few if any survivors to be found. If this be so, and Mr. Laws' and Dr. Andrewes' researches appear to render it highly probable (under the conditions of a laboratory experiment), how comes it that typhoid fever is propagated at all by the medium of sewage? The authors say that the bacilli have some powers of resistance to the unfavourable conditions to which they are subjected in sewage, sufficient at any rate "to allow of their being carried in sewage to remote distances, and of their being able to produce disastrous results should they gain access to any water supply." But surely their experiments tend to prove the very opposite. They failed to find any colonies of the bacillus in sewage, even when the sewage was taken from a sewer in Bridge Street, Homerton, only a quarter of a mile distant from the Homerton Fever Hospital, which discharged its sewage, containing the evacuations of typhoid fever patients, into this very sewer. Even when sewage was taken from the main drain of the hospital at Homerton, which contained at that time forty cases of typhoid in a block set apart for that disease, many being acute cases suffering from diarrhœa, and the disinfection of the stools being purposely in abeyance, only two colonies could be isolated as giving all the tests characteristic of the bacillus typhosus. Now, either the quantity of crude sewage submitted to experiment was too small, too great dilution of the sewage being practiced, so that typhoid bacilli if present were so attenuated in numbers as to be unrecognisable, or else the authors' contention is correct, that the bacilli, which undoubtedly gained access to the sewage of the Homerton Hospital in enormous numbers, are so rapidly destroyed therein as to be only found subsequently in very small numbers with the greatest difficulty.

If this is true, it becomes difficult to understand how specifically infected sewage plays any part at all in the dissemination of typhoid fever. And yet, that it does so is perhaps one of the best recognised facts in the science of Preventive Medicine, and receives,

indeed, the support of Messrs. Laws and Andrewes. The science of Bacteriology is still in its infancy. Until the life histories of the micro-organisms associated with disease have been more thoroughly elucidated, is it not wiser that we should suspend our judgments, and assign to the evidence carefully and toilfully collected by numerous epidemiological workers at least an equal value to the half revealed truths experimentally arrived at in the Bacteriologist's laboratory?

Epidemiologists and medical men generally recognise that small-pox, diphtheria, typhus, scarlet fever, and measles are conveyed by the passage of contagion through the air from the sick to the healthy. If the air of the sick-room occupied by a sufferer from any one of these diseases was pronounced on bacteriological evidence to be free from the specific microbe of the disease, such a statement would not alter in the slightest the previously held opinion that the air of the room was capable of propagating infection. Surely it is best to adopt the same attitude of mind with regard to the vexed question of the specific properties of sewer air—at any rate until the bacteriological opinions opposed to such a view rest upon a somewhat surer basis. The bacillary theory of the origin of infectious disease is not yet in a position to command universal support, when opposed *in toto* to the teachings founded upon the laboriously acquired facts of epidemiological investigation.

LOUIS PARKES.

"AN INTRODUCTION TO PRACTICAL BIOLOGY."*

Dr. Migula is lecturer on botany in the Grand-ducal Technical High School of Karlsruhe, and the origin of the little work was for the purpose of giving his scholars a short text book. The elaborate treatises on bacteriology of Hueppe, Frankel and others being too voluminous for the purpose. The author has therefore only selected the most approved methods of cultivating, mounting, and staining bacteria, and as far as possible has simplified the processes.

The book is essentially elementary, 170 of the 240 pages are occupied with the descriptions of methods of procedure, and in no work hitherto published have these matters of technique been more clearly described or more minutely detailed; so much is this the case, that most educated persons, having purchased the necessary appliances, could, by studying this book, obtain an acquaintance with the practical exercise of bacteriology without going to a bacteriological laboratory. Very few species of micro-organisms are described, and the recognition of these is referred mainly to their characteristic growths, to their behaviour with staining reagents, and to their appearance. The fault of the book is the neglect of the chemical re-actions which most bacteria produce; thus one will coagulate

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* By Dr. W. Migula, translated by M. Campbell, and edited by H. J. Campbell, M.D., M.R.C.P., Senior Demonstrator of Biology in the Medical School of Guy's Hospital. 8vo., 240 pages. Swan Sonnenschein & Co., London; and Macmillan & Co., New York.

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milk, another not. Indol, butyric acid, marsh gas, carbon dioxide, and other easily recognisable products are produced during the growth of certain micro-organisms, and these will be found a great aid to identification. As an example, the *bacillus coli communis* is distinguished from the typhoid bacillus by (1) coagulating milk; (2) producing indol in broth; (3) the production of gas in a "Shake" culture. It is obvious that such reactions are important in differentiating the various species, and should have been given a place in the text.

A. WYNTER BLYTH.

"MODERN METHODS OF SEWAGE DISPOSAL."*

The author has succeeded in condensing, most conveniently, many important results in sewage disposal which have been prominent during the last quarter of a century, and dealing as he does with principles and results, rather than with men and systems, the independent tone of the work renders it doubly valuable.

The art, as the author justly observes, is but on the threshold of real success, and much of the mystery which occluded our early work has disappeared and we have a vast amount of reliable experience to work on for the future.

The volume contains much which will educate those who while not studying the subject from an engineering point of view, are anxious as members of public authorities, to know something at least of a matter upon which they may be called to adjudicate.

The chapter on "Chemical Treatment" is highly instructive, as are also the following chapters upon sewage disposal for hotels and large institutions and for villages and country houses, and no one can find fault with the author's conclusions.

This small volume can be thoroughly recommended, and should find a place in every library which is devoted to Sanitary Literature.

LAMOROCK FLOWER.

"SEWAGE DISPOSAL WORKS."†

The object for which this book was written has evidently been attained, and the fact that it has run into a second edition proves that such a work was wanted.

Although any single example is of little value outside its own immediate locality, a fact which was noted by the early Rivers Pollution Commissioners, and the truth of which is taught by extended experience; still, examples put in the form adopted by the author, and

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* By Geo. E. Waring, Junr., M.Inst.C.E. 8vo., 252 pp. D. Van Nostrand & Co., New York; and Sampson Low & Co., London.

† By W. Santo Crimp, Consulting Engineer, M.Inst.C.E., &c. 8vo., 349 pp. Griffin & Co., London.

well illustrated as they are, prove most useful, if even only to show what to avoid.

The part devoted to London main drainage and sewage disposal is most interesting. It must not be forgotten that London sewage is of itself "a thing apart," passing without notice the vastness of the problem to be solved; this renders its history valuable, without setting up the practice adopted as one to be followed.

The example given of Margate shows how a seaside town, the sewage of which has to be run into the sea, may be dealt with. It remains to be seen in practice whether this place will be more successful than other towns on the Kentish Coast.

The work requires to be carefully studied to be appreciated, and it will form a valuable addition to the library of all students of Sanitation.

LAMOROCK FLOWER.

NOTES ON BOOKS PRESENTED TO THE LIBRARY.

"A Manual of Practical Hygiene; Designed for Sanitary and Health Officers, Practitioners and Students of Medicine," by W. M. L. COPLIN, M.D., and D. BEVAN, M.D. 456 pp. 8vo. *P. Blakiston, Son & Co., Philadelphia. Price 16/-*

The authors, who are respectively the adjunct Professor and the Instructor in Hygiene, &c., at Jefferson Medical College, have here endeavoured to set before students in sanitary science the first complete text-book on the subject from an American standpoint. Considerable space is given to the Causes of Disease and the Means of their Prevention, Food, Water, Air, Habitation, Sewage, Disposal of the Dead, and the numerous other subjects which are included in the wide range of Hygiene, are also dealt with. The book is well illustrated.

"Dwelling Houses," by Prof. W. H. CORFIELD, M.A., M.D., Medical Officer of Health for St. George's, Hanover Square. *H. K. Lewis. Price 3/6*

This is the third edition of Dr. Corfield's well-known book dealing, in a short and practical manner, with Construction, Ventilating, Lighting and Warming, Drainage and Water Supply, of Houses.

"Domestic Hygiene," by THOMAS DUTTON, M.D. Univ. Durh. M.R.C.P. Edinb., &c. 196 pp. 8vo. *H. Kimpton. Price 2/-*

The author here endeavours to treat the subject in such a manner that the reader should be able to apply the first principles of Hygiene

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to the household. Among the subjects dealt with are Ventilation, Domestic Water Supply, Nursing, Preventible Disease, Clothing, School Hygiene, &c.

"Refuse Destructors: Results up to the Present Time," by CHARLES JONES, M. Inst. C.E., Surveyor to the Ealing Local Board. *Biggs & Co. Price 5/-*

Mr. Jones, who is well-known for his interest in this subject, has in this volume brought together the results of the working of Destructors in different parts of Great Britain. He has also included a paper on "The Utilization of Town Refuse for Power Production," by Thomas Tomlinson, B.E., A.M.I.C.E.

"Infectious Diseases, Notification and Prevention," by LOUIS C. PARKES, M.D., D.P.H., Medical Officer of Health for Chelsea. *H. K. Lewis. Price 4/6*

This book is written (as stated in the preface) with the object of placing in the hands of the profession a small, compact volume, containing all the enactments in force in England and Wales dealing with Infectious Diseases; other matter is also introduced dealing with Incubation, Quarantine and Infective periods, practical working of Isolation at Home, and Disinfection.

"The Sanitary Arrangement of Dwelling Houses," by A. J. WALLIS-TAYLER, Assoc.M.Inst.C.E. 196 pp. 8vo. *Crosby, Lockwood & Co. Price 2/6*

Intended as a Handbook for Householders and Owners of Houses, the author has endeavoured to treat the subject in such a manner as to enable the non-professional householder to understand the sanitary arrangements of his own dwelling. An Appendix gives the provisions of the Public Health Act, 1875, of the Public Health (London) Act, 1891, and clauses of the Model Bye-Laws with reference to the Sanitary Arrangement of Dwelling Houses, and also the Regulations of the Metropolis Water Act, 1871, which should prove useful to the householder for reference.

"In den gewerblicken Betrieben Vorkommende Staubarten in Wort und Bild. Herausgegeben vom Vereine zur Pflege des Gewerbe Hygienischen Museums in Wien." Mit 11 Tafeln in Lichtdruck. Wien 1892. Published by the Association for the Maintenance of the Industrial Hygienic Museum in Vienna. *Price 2 gulden.*

The various kinds of dusts met with in industrial processes are described and illustrated by 11 plates in photo-lithography, these plates contain 44 photographic illustrations of different dusts. The text is a description of the plates, classified under the heads of metal dusts, stone dusts, dusts of turning processes, wood dusts, dusts of textile industries, and miscellaneous dusts. The work is edited by Dr. F. Migerka.

A CONTRIBUTION TO A BIBLIOGRAPHY OF HYGIENE.

PART III.

BY G. J. SYMONS, F.R.S.

THIS list is avowedly incomplete, but it gives the titles of some recent works on Sanitary subjects, which books were not mentioned in my previous lists, and are not yet in the Library of The Sanitary Institute.

Albrecht, H. Handbuch der praktischen Gewerbehygiene. Liefg. 2. Berlin, 1894. 4/6
 III. Bau und Einrichtungen von Fabriken und Werkstätten.
 IV. Heizung und Lüftung der Arbeiterräume.
 V. Verhütung der Einatmung von Staub.

Arnould, J. La stérilisation alimentaire. Paris, 1894. 2/6

Atkins, W. G. The modern system of Water Purification. 1st Part: Water Softening. 8vo. 180 pp. 1894. 1/-

Babes, V. Mittheilung über einige bei Influenza gefundene Bakterien. Jena, 1890. Mit 6 Photogr. 1/-

Banner, E. Gregson, *C.E.* Wholesome Houses: A Handbook on Domestic Sanitation and Ventilation. New and Revised Edition. Illustrated with numerous Engravings. Crown 8vo. 2/6

——— House Drainage. Crown 8vo. Wrapper. -/6

Beckmann, W. Ueber die typhus-ähnlichen Bacterien des Strassburger Wasserleitungswassers. Strassburg, 1894. Mit Tab. 1/-

Bevan, G. Phillips, *F.S.S.* The London Water Supply: its Past, Present, and Future. With Coloured Map showing the Districts of the Water Companies. Crown 8vo. 1/6

Bissell, Mary T. A Manual of Hygiene. 12mo. (New York.) London. 8/6

Blasius, R. (*See* Weyl, Th.)

Bluhm, A. (*See* Weyl, Th.)

Bologowski, Mme. S. Sur le choléra asiatique de 1892-93 au Russie et sur les mesures administratives prises par le gouvernement contre cette épidémie. 8vo. Paris, 1894. Avec 1 carte. 1/6

Braatz, E. Rudolph Virchow u. die Bakteriologie. Jena, 1895. 1/-

Buesing, F. W. (*See* Weyl, Th.)

Burton, W. K., *Assoc.M.Inst.C.E.* The Water Supply of Towns and the Construction of Waterworks; a Practical Treatise for the use of Engineers and Students of Engineering. With a Paper on the Effects of Earthquakes on Waterworks, by Prof. JOHN MILNE, F.R.S. Numerous Plates and Illustrations. Cloth. Royal 8vo. 1894. 25/-

Carpenter, A. The Principles and Practice of School Hygiene. With Illustrations. 4th Edition. Post 8vo. 370 pp. 4/6

Chevreau, Ch. Etude sur les eaux d'alimentation de Vitry-sur-Seine 4to. Paris, 1894. 1/-

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NOTES ON LEGISLATION AND LAW CASES.

Prepared by Prof. A. Wynter Blyth.

COURT OF APPEAL.

Before the Master of the Rolls, Lords Justices Lopes and Rigby.

(*Times*, Jan. 27th, 1895.)

PILBROW *v.* VESTRY OF ST. LEONARD, SHOREDITCH.

Definition of "drain" under the Public Health and Metropolis Local Management Acts. Sets of Artizans' Dwellings draining into a common drain. The judgment of the Divisional Court upheld, viz., that the "common drain" was a drain and not a sewer, and that the premises were within one curtilage.

This was an appeal from a judgement of a Divisional Court (Mr. Justice Mathew and Mr. Justice Charles), on a special case stated by a metropolitan police magistrate, reported 11, *The Times* Law Reports, p. 14, Journal Sanitary Institute, Vol. XV., 760. In August, 1892, the appellant Pilbrow appeared to a summons issued by the vestry of St. Leonard, Shoreditch, to recover expenses to the amount of £209 7s. 6d., incurred by the vestry as sanitary anthority for the parish in cleansing and amending the drains at Norfolk-buildings, of which the appellant was the owner. These buildings consisted of forty-six sets of apartments divided into two blocks separated by a causeway 20ft. wide. They were erected and the drains were put in by the owner in 1882 without any plans having been submitted to the local authority or any inspection or sanction of the drains by them. The drainage was by means of twelve branch drains running into a main drain under the causeway which ran into a sewer within 100ft. of the blocks. The main drain was a single 9in. pipe. The branch drains were inserted into the main drain through holes cut in that pipe. On November 18th, 1891, the Inspector of Nuisances gave notice to the owner to amend and reconstruct the main drains and provide a properly-ventilated inspection chamber, and to amend the branch drains, and to disconnect certain waste pipes. This requisition was not complied with, and the works were ultimately done by the vestry at the cost demanded. The appellant contended that no order could be made against him, because the alleged main drain was used "for the drainage of more than one building," and not "for draining any block of houses by a combined operation under the order of any vestry or district board," and was therefore not a "drain" but a "sewer" within

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the meaning of the interpretation clause, Section 250, of the Metropolis Management Act, 1855 (18 and 19 Vict., c. 120). The magistrate held that the alleged main drain in question draining blocks of houses by a combined operation was, under the circumstances and notwithstanding the absence of any order of the vestry for the purpose, a "drain" and not a "sewer" within the meaning of the Acts, and made an order on the appellant to pay the amount charged. At the request of the appellant the magistrate stated a special case for the opinion of the High Court. The Divisional Court upheld the decision of the magistrate. The appeal was brought from that judgment. By Section 250 of the Metropolis Management Act, 1855, "the word 'drain' shall mean and include any drain of and used for the drainage of one building only, or premises within the same curtilage."

Mr. Haldane, Q.C., and Mr. R. Woodfin appeared for the appellant; Mr. Finlay, Q.C., and Mr. Lewis Thomas for the respondents.

The Court (Lord Justice Rigby dissenting) dismissed the appeal.

The Master of the Rolls said that the question was whether a certain thing, which had been constructed and used in a particular way, was a "drain" or a "sewer" within the meaning of Section 250 of the Metropolis Management Act, 1855. The Divisional Court had held that it was a drain, because it was built for the purpose of draining a curtilage. In his opinion the interpretation of the section did not in any way depend on considerations of conveyancing law. He thought that what they had to consider was the object with which the structure was built and the manner in which it was used. The case was that a definite small space of ground had been built upon for the purpose of being used as one set of premises. Two blocks of buildings were erected, and between them a causeway was made, and it was clear that that causeway was intended to be a yard for the whole set of premises. The smallness of the space was certainly one of the matters to be taken into consideration. The whole was enclosed within boundary walls, and he thought that all within those boundary walls was substantially, having regard to the intentions of the builder, one building. In these premises forty or fifty families were to reside, each having its own separate apartments; the staircases and everything else except the separate apartments were to be used in common by all. He thought that, as a matter of building and as a matter of use, the two blocks and the yard formed one set of premises, and that the boundary walls form a curtilage, and that, therefore, the yard was a yard within the curtilage. In this yard the builder laid a drain to collect the sewage from the two blocks and carry it into what was undoubtedly a sewer. What he so laid in the yard was certainly what in ordinary language anybody would call a drain. They were asked to hold that the Act of Parliament had turned that which was in fact a drain into a sewer. He could see no reason for so doing, and he agreed with the judgment of the Divisional Court. They had been pressed with the case "Vestry of St. Martin-in-the-Fields *v.* Bird" (39 *Solicitors' Journal*, 131, Journal of Sanitary Institute, Vol.

XV., 762), in which they had held that the Lowther-arcade was not a curtilage. In his opinion that case was quite different from this.

LORD JUSTICE LOPES concurred.

LORD JUSTICE RIGBY differed. He thought that the word "curtilage" was never applied to anything which was common to more than one messuage. The idea of something belonging to a dwelling-house seemed to run through all the definitions which had been given of the word. In his opinion there was no authority for treating "curtilage" as equivalent to ring fence or boundary. The element of smallness was, no doubt, one matter to be considered; but it was by no means the most important thing. He thought that in considering the meaning of "curtilage" the main distinction to be drawn was that between a plurality of messuages and a single messuage. Here there were at least two messuages—viz., the two blocks of buildings. If one of the blocks were conveyed separately, no doubt an easement might be created with regard to the use of the causeway; but the causeway could not be considered any part of the curtilage of that block. He therefore thought that, on the construction of Section 250 of the Metropolis Management Act, these were not premises within the same curtilage. It appeared to him that the present case was governed by the Lowther-arcade case, the legal incidents of the two cases being the same.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Before Mr. JUSTICE CAVE and a Special Jury.

(*Times*, March 9th, 1895.)

EUSTACE *v.* LEYTON LOCAL BOARD.

An action for injunction and to recover damages with respect to a nuisance arising from the Local Board depositing and permitting to be deposited rubbish in an old gravel pit at the back of plaintiff's house, and also, it was alleged, that the plaintiff's daughter had contracted scarlet fever from the state of the gravel pit. Jury found for plaintiff on the question of general damage only £100.

This action was brought by a carpenter, residing at 5, St. Joseph's Terrace, Leyton, to recover damages on account of his little daughter having caught scarlet fever through the acts of the defendants' servants in shooting filth into an old gravel pit at the back of plaintiff's house. He also claimed an injunction and damages for nuisance. The defendants denied liability.

Mr. Cyril Dodd, Q.C., and Mr. Arthur Gill were for the plaintiff; Mr. Cock, Q.C., and Mr. C. Munroe for the defendants.

The plaintiff's case, as opened by counsel, was shortly as follows: He had resided several years in Leyton, and since 1888 had had on four separate occasions to complain of all sorts of filth—road scrapings, sludge, and diseased animals, chiefly of the canine tribe—being thrown by the defendants, through their contractor and

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servants, into a disused gravel pit which was situated in a field at the back of his house. The first complaint was in 1888, the second in May, 1890, and the third in October, 1883, and the last in May, 1894. In May last the plaintiff's little girl was coming home to dinner from school when she (to use her own words) got the smell all down her throat. She immediately sickened, and within a week had to be sent to the fever hospital where she remained for 12 weeks suffering from scarlet fever. When complaint was made defendants at once "inspected" plaintiff's drains, but they were found to be in good order. This action was then brought.

Mr. Henry Eustace, the plaintiff, his wife, son, and two daughters were called, and gave evidence as to carts bearing the name of the contractor and of the local board having deposited sludge and road scrapings in the pit frequently. Road scrapings included animal and vegetable matter, and dead cats and dogs.

In cross-examination, it was denied that the offensive matter was thrown in by "outsiders." There had been "fish" in the pond till 1892, when they had died off. The dead dogs were brought for burial and not taken away. There was no scarlet fever about at the time nor had there been any cases within three months at the school the little girl attended.

Dr. Batley, of Leyton, said he had attended the little girl for scarlet fever, and ordered her removal to the hospital.

Cross-examined.—He had never heard of a child catching scarlet fever from an evil smelling pit. It could only be caught from an infected person or his clothes, &c.

Mr. Bond, surgeon, of Leyton, said that scarlet fever germs might be conveyed in almost anything. The germs might be in the air, in dust, in milk, or in anything exposed to infection. "Road sweepings" in Leyton included almost anything, from the refuse of a fishmonger's, greengrocer's, or butcher's shop to dead animals, such as cats and dogs. Such a pit would predispose people in the vicinity to infection.

Cross-examined.—He had never heard of a person catching scarlet fever from a pit such as this; but he knew no reason why such a thing should not occur. The period of incubation varied from two hours to a week. The ordinary period was forty-eight hours. Scarlet fever germs might be present almost anywhere.

Other evidence was given as to the existence of a nuisance from the smell.

Mr. Cock, Q.C., in opening the defendants' case, said it was very easy to have a shot at a local board, especially when there was a lawyer's clerk in the family. The pit belonged to a Mr. Vallance. Gravel had been taken from the place, and Mr. Vallance put up a notice inviting people to "shoot dry rubbish" there. Unfortunately people had not confined themselves to dry rubbish, but with that the local board had nothing whatever to do. In October, 1893, Bent, who was their contractor for the removal of household refuse, did shoot some rubbish there, but Mr. Eustace objected, and it was at once stopped. Early in 1893 road sweepings were shot there, the

best possible stuff to cover the loads of vegetable and animal refuse left by other people. Of this, too, Mr. Eustace complained, and it was stopped. In July, Mr. Harris, another contractor, put in two loads of stuff from the "gullies" or drains, but that was a mistake, and was also stopped.

Mr. Horatio Miller, who had been a provision dealer and was now inspector of nuisances for the defendants, said the pit was in a very fair state in 1892. In September of that year he received a complaint as to dead dogs, which he had removed. He had receipts for their removal. He often visited the pit early in 1894, and saw vegetable and animal refuse there. It was a general receptacle for the neighbourhood. He used to ask the road surveyor to send down a load of road scrapings to cover up this refuse. He always did that when there were any complaints. They could never "nab" any one leaving rubbish there, and they never set a man to watch. Harris, who had the contract for clearing the roads, would not be allowed to put a dead dog in his cart. If he found one in the road, he would take it away on a shovel, or in a wheelbarrow if it was a large one.

Other evidence was called for the defence, the effect of which sufficiently appears from the summing up.

Mr. Justice Cave, in summing up, said the plaintiff complained—(1) Of a nuisance to his house and to the users of the neighbouring road; and (2) that owing to that nuisance Clarissa Eustace caught the scarlet fever. With respect to (1) the damages would be general—enough to insure him from its happening again. With regard to the fever, it did not appear that he had suffered any pecuniary loss, and damages could only be for suffering to the daughter. A discreditable state of things in Leyton was disclosed by the evidence. No doubt there had been a nuisance for a long time, and there had been considerable slackness on the part of the local board. But unless the jury considered they had had something to do with creating the nuisance, the action would not lie. They might suspect that Mr. Bent caused the nuisance. His were the only carts which had the name of the local board on them, and the evidence showed that such carts did discharge rubbish in 1894. But that was not enough, unless the local authority agreed to his shooting the rubbish there. They had, however, sent a man to level this rubbish, and cover it with "road slop." Now "road slop" was matter which, if put over animal and vegetable filth, would hardly act as a disinfectant. Did they by this contribute to the nuisance? As to the scarlet fever, the evidence was all one way, and when scientific evidence did agree, it was entitled to great weight. The doctors agreed that the fever could not be contracted directly from such a place; but that living in unhealthy surroundings produced a lowered vitality which might render infection more dangerous. If they thought that the fever here was caused by lowered vitality, owing to the nuisance, then they would award damages. If they thought it too remote, they would find for the defendents on that part of the case.

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The jury found for the plaintiff on the question of general damage only—damages £100.

Judgment accordingly.

HIGH COURT OF JUSTICE.—QUEEN'S BENCH DIVISION.

Before Justices Wills and Wright.

SELF v. HOVE COMMISSIONERS.

Drain common to two houses owned by different owners in a district in which Part III. of the Public Health Acts Amendment Act is in force.

This was an appeal from the judgment of the Judge of the Sussex County Court, in which court it had been held that the Local Authority was liable for the expense of draining two houses which were redrained pursuant to the notice of the Local Authority.

Nos. 1 and 2 Ivy Place, situated in Hove, a district which has adopted Part III. Public Health Acts Amendment Act, 1890, were drained by one common drain. Mrs. Self owned No. 2 and the drain of this house being found defective the Local Authority served the usual notice and threatened to enforce the same. On the drain being opened it was found to receive the drain of No. 1; a notice was also served on No. 1. No. 1 was owned by a Mrs. Vickers. The houses were semi-detached, each having a yard, the yards being separated by a wall. Mrs. Self drained both houses into the common sewer, and paid for the work which was done under the superintendence of the Local Authority. She then summoned the Local Authority in the County Court for the expenses.

The County Court Judge on the authority of Travis v. Uttley (70 L. T. Rep., 242, Journ. of San. Inst., Vol. XV., 298), held that as the drain took the drainage of more than one house it was a sewer within the meaning of sec. 4 of the Public Health Act, 1875, and that the Local Authority were therefore bound to repair or renew. He also found that the notice given by the Local Authority operated as a request by the said Authority to do the work on their behalf, and he gave judgment for the amount claimed by Mrs. Self with costs.

The Local Authority of Hove appealed.

The Court reversed the decision of the County Judge.

Mr. Justice Wills stated that the notice to do the work was not a request on the part of the defendants, but that on the contrary it was a notice calling upon the plaintiff to do the work as a matter of right and saying in effect, "If you do not do it legal proceedings will be taken against you, because we claim that it is your duty to do it," and under these circumstances he was quite unable to see that there was anything in the notice equivalent to an express request. As to the second point raised for the plaintiff, viz., that the defendants were liable to do the work themselves, and that as the plaintiff had

done it, being herself under no legal liability to do it, therefore the request was implied, the defendants were under no legal liability to do this particular work. They were under a legal liability to have an effective sewerage system, but there was no section in the Act of Parliament, which said in so many words that they should be obliged to do any particular work; and he was inclined to think that was a matter within their own discretion. Actions had been attempted against local boards, for not doing a specific thing, but he did not think they had ever been successful. There was, however, a higher ground than that, because under section 19 of the Public Health Act, 1890, this liability fell on the plaintiff. Section 19 provided (1) that where two or more drains belonging to different houses were connected with a public sewer by a single private drain, an application might be made under section 41 of the Public Health Act, 1875 (relating to complaints as to nuisances from drains) and the local authority might recover any expenses incurred by them in executing any works under the powers conferred on them by that section from the owners of the houses in such shares and proportions as might be settled by their surveyor or (in cases of dispute) by a Court of summary jurisdiction (2) that such expenses might be recovered summarily or be declared by the urban authority to be private improvement expenses under the Public Health Act, and recovered accordingly and (3) that for the purpose of that section the expression drain included a drain used for the drainage of more than one building. That section applied when premises were occupied by different owners and were connected with the public sewer by a single private drain under the interpretation clause applicable to that particular section. Under those circumstances, the defendants, the Hove Commissioners, would have been entitled to give a written notice under section 41 of the Act of 1875, and having given the written notice to have compelled the plaintiff to do all that she had done. Supposing it had been otherwise, he thought it was still doubtful whether the plaintiff could have recovered. But the question raised an exceedingly nice point. If a summons had been actually taken out and the plaintiff had submitted to it he felt no doubt at all that upon the authorities she could not afterwards have claimed to have recovered back that to which she had submitted. He thought it perfectly clear that if a summons had been taken out and legal proceedings initiated; a claim could not afterwards have been made by the plaintiff, for it would be allowing the same matter to be dealt with twice over on different sets of proceedings between the same parties. There was in this case a mere threat of legal proceedings which was acquiesced in, and he was by no means sure how such a case as that should be dealt with. There seemed no doubt that if a legal right was put forward by a person in authority, a person having special standing ground, which enabled him to exert anything like undue influence or compulsion, so that the transaction bore anything like the stamp of oppression, an action would lie; but he did not think that was the case here. The learned County Judge had found nothing of the kind, and the position taken by the Local Board was assumed

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to have been quite *boná fide*, and he did not think the liability—if there was one—on the part of the defendants to repay the money would arise upon that state of circumstances. Then it could not arise on a mistake of fact because there had been no mistake of fact. The fact was that the action was founded upon a mistake as to legal liability, common to both the plaintiff and the defendants. His strong impression was that under such circumstances no such action could be maintained, although the present plaintiff acted upon a threat of legal proceedings, without waiting for a summons to be taken out by the other party. For the reasons given, there was no legal liability, and the decision of the County Court Judge was wrong and the judgment must be reversed. It did not appear that the Borough of Halifax in which the case of Travis *v.* Uttley arose had adopted the Public Health Acts Amendment Act, 1890, which fact entirely distinguished that case from the present one.

Mr. Justice Wright concurred.

Appeal dismissed.

Before Mr. Justice Collins.

Jones *v.* Banter.

In a case where the drains of two houses joined and therefore the common drain was technically a sewer, and the local authority wrongly by notice required the drains to enter separately into the sewer, the owner of one house complied, the other did not, and consequently nuisance arose, the Court held that the Local Authority were liable to remove any nuisance.

This was an application by Mrs. Elizabeth Jones, owner of Nos. 2 and 4, Wimbolt Street, Bethnal Green, for an injunction restraining Mrs. Ann Banter, the owner of Nos. 6 and 8, Wimbolt Street, from allowing to continue obstructed the free passage of running water and soil from the plaintiff's houses along the drains and sewers under the defendant's premises.

Mr. Cock, Q.C., and Mr. Mallinson appeared for the plaintiff, while Dr. Macmorran represented the defendant.

It appeared that both plaintiff and defendant held their respective premises on leases granted by the same ground landlord, and that by the leases plaintiff was entitled to a free passage for the water and soil coming from her houses into and along the drains and sewers under the defendant's premises. A short time since the defendant was served by the vestry of St. Matthew with notices, pointing out that the system of drainage in connection with her houses was defective, aud calling upon her to relay and make good the same. Believing that it was her duty to comply with the notices she called in a builder, who relaid the drains to the satisfaction of the inspector of the vestry. The level of the drain of No. 6 was altered, with the result that the drainage from No. 4 could not flow into it. The vestry then threatened the plaintiff with proceedings for creating a nuisance, and she applied to Mr. Justice Day at chambers for an

injunction restraining the defendant from continuing to obstruct the flow of the drainage of No. 4 into the drain of No. 6, and the learned judge referred the application to the Court. The plaintiff now contended that the defendant ought not to have paid any attention to the notices of the vestry, because the pipe through which the sewage passed was not a drain but a sewer, and therefore repairable by the local authority. She further asserted that the defendant by carrying out the work had converted a sewer into a drain and thereby rendering her (plaintiff) liable to penalties for an alleged nuisance.

Mr. Justice Collins, after hearing the evidence, said the pipe in question was admittedly a sewer, and not a drain, and therefore the local authority was liable to remove any nuisance, and not the defendant. He granted an injunction, and awarded plaintiff 40s. and costs.

GENERAL NOTES.

Tinned Green Peas.—At the Edmonton Petty Sessions, Messrs. Kearley & Tong, Fore Street, Edmonton, were summoned for selling an article of food, a tin of green peas, which were coloured by the aid of copper, thereby rendering them injurious to health. The evidence showed that the article was purchased on January 10th, and an analysis proved it to contain 7-10ths of a grain of copper, which was equal to 2·75 grains of sulphate of copper. Dr. J. F. J. Sykes, Medical Officer for St. Pancras, Dr. Dupré and Dr. Luff, analysts to the Home Office, stated that sulphate of copper was a poison, which, if taken into the system in the quantities found in the peas would produce chronic poisoning. The copper was used to make the peas retain their greenness, and the effects would be most injurious, especially to weakly persons. For the defence, it was stated there were 16,000,000 tins of the peas imported annually, and yet no case had proved they had produced any injurious effects. The article was sold in the ordinary course of trade, and if it was poisonous, then the question was essentially a State one, and their importation should be stopped. Several cases were quoted to show that the Courts had held the article was not injurious, and in support of this Mr. Otto Hehner, Public Analyst for Nottinghamshire, was called, and said though there was more than the usual quantity of copper in the sample in question, he did not think it would produce the ill effects suggested by the prosecution. After a hearing lasting over four hours the Bench inflicted a fine of £1 and 20 guineas cost. Notice of appeal was given.—*Journal of Horticulture, March 14th*, 1895.

The First Number of the New Chilian Journal of Hygiene has recently been issued. It is published under the direction of the Institute of Hygiene recently established in Santiago, and is printed in Spanish. The present number confines itself to the history and development of the organisation of public hygiene in general throughout Chili, and an account is also given of the provision for official hygienic administration in Germany, France, England, and Belgium. One of the functions exercised by the Santiago Hygienic Institute is the analysis of substances for purposes of

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trade and commerce, and the granting of official certificates as to their quality. Considering the enormously high death-rate of Santiago, which is stated to reach 57 per 1000, some reform in hygienic matters is urgently needed, and it is to be hoped that the establishment of this new Bureau of Public Health may beneficially stimulate public and private enterprise in this direction.—*Nature, March 14th*, 1895.

A PRIZE FOR RESEARCH INTO TUBERCULOSIS.—At the last quarterly *comitia* of the Royal College of Physicians of London, Sir J. Russell Reynolds, M.D., in the Chair, it was announced that Dr. Hermann Weber, a Fellow of the College, gave, last December, the sum of £2,500 in trust for the purpose of founding a prize to be called the "Weber-Parkes Prize," to be given at intervals for the best essay on tubercular consumption. A committee was appointed to confer with Dr. Weber as to the best methods of giving effect to his wishes, and the following regulations, unanimously recommended by the committee, were now adopted:—That the prize founded by Dr. Hermann Weber in memory of the late E. A. Parkes, M.D., be termed the "Weber-Parkes" Prize; that the prize be awarded triennially to the writer of the best essay upon some subject connected with the etiology, prevention, pathology, or treatment of tuberculosis, especially with reference to pulmonary consumption in man; that, in making the award, the College have regard to, careful collection of facts and original research; that the value of the prize be 150 guineas, or such sum as the interest accrued on the capital, after payment of expenses, will permit; that a bronze medal be awarded to the holder of the prize, and a similar medal, to be distinguished as the "second medal," to the essayist who comes next in order of merit. The remaining regulations provide for the appointment of an adjudication committee, which shall select the particular subject for competition, and adjudicate upon the essays sent in; the adjudication to be made every three years. The competition will be open to members of the medical profession in all countries, the essays to be type-written, and if written in a foreign language to be accompanied by a translation in English. It is a condition of the competition that each prize essay shall become the property of the College, though the College may grant its author permission to publish it.

ARTIZANS' DWELLINGS FREE.—At a meeting held at the Westminster Palace Hotel, on 13th February last, Mr. Stanley Boulter propounded a scheme for the application to artizans' dwellings of the principle of the Irish Land Purchase Act of 1885. The main feature of the scheme is that English municipalities shall be empowered to advance to the working classes the necessary money to purchase their houses, and that the advances shall be repaid, together with interest at 3 per cent., by weekly instalments over a term of years, instead of rent, thus in effect providing free homes for the people, due regard being given for a sufficient margin of security to the local authority lending the money, and to proper provision for the maintenance and repair of the property.

ANTITOXIN TREATMENT FOR PNEUMONIA.—L'Union Medicale, of December 8th last, reviews this treatment, as applied to pneumonia, in a similar manner to diphtheria and tetanus. Dr. F. P. C. Klemperer, in treating patients with the serum of rabbits rendered immune, found in a proportion of the patients a lowering of the temperature, pulse, and respiration, leading to recovery. Similar good results followed with the use of cultures of the pneumococcus tested to 60° C, and the use of serum from patients who had passed the crisis. Foa, Carbone, Scolia, Jansen, and Lara, have also

reported the successful treatment of patients by the injection of pneumonia antitoxin serum, and so far the methods appear promising.

VAN DWELLERS.—At the fourth annual meeting of the United Kingdom Showmen and Van-dwellers' Protection Association, held at the Agricultural Hall, Islington, the Rev. J. Howard Swinstead, of Salisbury, presided, and there was a large attendance, representatives being present from London, Paris, Manchester, Liverpool, York, Oldham, Norwich, Lynn, Thetford, Stroud, and other places. The annual report, which was presented by Mr. F. T. Salva, the secretary, showed that the association was gradually making its way among the van-dwellers of the country. The chairman said that his experience of travelling showmen had proved to him that they desired to do for themselves what many meddlesome legislators would do for them by other means. Mr. Salva, the secretary, said that the van-dwellers had again been attacked by Mr. George Smith, but his efforts had been productive of good in establishing the present protective association on a firm basis. He complained that the Home Secretary had broken faith with them in connection with the bye-laws of the Essex County Council. It was promised that those bye-laws should not be allowed to interfere with the legitimate rights of the travelling showmen. The committee had come to the conclusion that they could expect nothing from the Government in power. Mr. Salva moved, Mr. Burnett seconded, and Mr. James Dean (the president) supported the following resolution, which was carried unanimously:—"That this meeting calls upon Mr. M. Fowler, M.P., Mr. Charles Fenwick, M.P., and other supporters of the Movable Dwellings Bill not to again back, support, or introduce their measure until they have receeived a deputation of showmen, who claim the right to be heard on legislation which concerns nobody but themselves."

THE AIR OF THE HOUSES OF PARLIAMENT.—Mr. James Keith has prepared a further report on the heating and ventilation of the Houses of Parliament. He says that the sewer gas, which is openly liberated into the lower sections of the ventilating shafts, finds its way into the Committee-rooms and Press gallery, and occasionally into the Debating-chambers of both Houses of Parliament. He further says that the atmosphere of the Committee-rooms and corridors is contaminated through the arrangements for ventilating the adjoining lavatories. His recommendations for remedying these defects are that the sewer gas should be liberated through separate pipes running to the top of the tower, and that silent fans should be used for extracting the vitiated air, instead of coke fires as at present.

THE LONDON BUILDING ACT.—The Paris Correspondent of the *British Medical Journal* says the London Building Act, put into practice January 1st, 1895, has not passed by unnoticed this side of the Channel. It is recognised to be of great sanitary importance. In France the height of the houses has been regulated for more than a century. The decree of April 10th, 1783, confirmed by the law of 1792, fixed the height of houses in streets 30 feet wide at 50 feet; in streets not 80 feet wide at 45 feet. In the principal French towns, the height was fixed by local authorities by the regulation of July 24th, 1874; houses in streets less than 7·80 metres wide were limited to 12 metres in height; in streets 7·80 metres in width they are allowed to be 15 metres high; in streets 9·75 metres in width the houses may reach 18 metres; in those 9·75 metres wide 20 metres: in streets still wider the houses may be still higher. M. Trélat wishes to see the streets one and a half times wider than the houses are high. Other sanitarians consider this too much, and that if the height of the houses and width of the streets are equal, nothing more can be reasonably asked for.

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ANNUAL REPORT OF THE COUNCIL,

For the Year 1894.

Read at the Ordinary General Meeting, March 20th, 1895.

NEW PREMISES.

The Council are glad to be able to report that the negotiations for obtaining additional premises in Margaret Street, which were referred to in the last Annual Report, have been satisfactorily completed. The remainder of the lease of 72, Margaret Street, a house adjoining the Museum, has been purchased and the premises have been adapted for the purposes of the Institute, and connected with the Museum. This has involved considerable alterations. The house affords Offices, Library and Reading room, Council and Committee Rooms, &c.

The premises newly taken over have been lighted throughout with electric light, both on account of its sanitary advantages and in regard to the safety of the valuable Library.

When reconstructing the drainage, advantage was taken of the opportunity to plan the drainage in such a way as to make it not only instructive but useful for testing and experimental purposes.

The accommodation afforded by the new premises, which was much needed, has greatly facilitated the work of the Institute, besides allowing additional space to be devoted to the Museum and Library. In addition to this, the rooms in the basement have been arranged with a view to making them available for testing purposes: they have already proved of considerable use in this respect, and will be of still greater value in the future.

The sum of £1,000 voted at the Extraordinary General Meeting held on July 4th, 1894, for the enlargement of the premises and the adaption for the purposes of the Institute has not been exceeded, as will be seen by reference to the paragraph headed "Finance."

SESSIONAL MEETINGS.

Sessional Meetings were held in January, February, April, and December. The following papers were read and discussed :—

"The Etiology, Spread, and Prevention of Diphtheria." R. Thorne Thorne, c.b., m.b., f.r.s., Medical Officer of the Local Government Board.

"The Sanitation of places where Food is Stored and Prepared." (A) *Bakehouses.* (B) *Kitchens of Restaurants.* F. J. WALDO, M.A., M.D., D.P.H., Medical Officer of Health, St. George-the-Martyr, Southwark, Inner Temple and Middle Temple.

"The Construction of Roads and Streets from a Sanitary point of view." LEWIS H. ISAACS, F.R.I.B.A., ASSOC.INST.C.E., Surveyor to Board of Works, Holborn District.

"The Sanitary Aspects of the London Building Act, 1894." GEORGE BLUNDELL LONGSTAFF, M.A., M.D., F.R.C.P.

The papers read during the earlier part of the year, have already appeared in the Journal, the paper by Dr. Longstaff will be published with the proceedings of the other meetings of the Session 1894-5 in Part II. of the Journal for 1895.

The attendances at the meetings were good, varying from 100 to 200.

LECTURES FOR LADIES.

The seventh course of Lectures on Hygiene, especially intended for Ladies, was given during Lent by A. T. Schofield, M.D., M.R.C.S. The subject of the Lectures was Modern Hygiene in Practise in Infancy, in Childhood, in Adolescence, in Maturity and Decay. Demonstrations of calisthenic exercises and chemical experiments were given to illustrate the Lectures. There was a large attendance of ladies.

Her Royal Highness the Duchess of Albany was present at several of the Lectures, and at the end of the course, at a special meeting held for the purpose, Her Royal Highness presented Certificates to those Ladies who had written satisfactory reports upon the lectures.

LECTURES ON METEOROLOGY IN RELATION TO HYGIENE.

A suggestion was made to the Royal Meteorological Society, and by it to The Sanitary Institute, that many Medical Officers of Health and others would be glad to gain some further information on the important question of Weather and Climate in relation to Health and Disease.

As the question involved both Meteorology and Hygiene, it was thought well by the respective Councils that the two Societies should jointly arrange a course of Lectures upon this subject.

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The following Six Lectures dealing with some of the principal factors and points for consideration were given, and have proved the means of spreading much useful information.

"Instruments and Observations and their Representation." G. J. SYMONS, F.R.S.

"Temperature of Air, Soil and Water." H. R. MILL, D.SC., F.R.S.E.

"Barometric Conditions and Air Movements." R. H. SCOTT, M.A., F.R.S.

"Moisture, its Determination and Measurement." W. MARRIOTT, F.R.MET.SOC.

"Climate in Relation to Health, and Geographical Distribution of Disease." C. THEODORE WILLIAMS, M.A., M.D., F.R.C.P.

"Fog, Clouds and Sunshine." F. GASTER, F.R.MET.SOC.

The Lectures were published in Part II. of the Journal of the Institute, 1894, and by the liberality of one of the Fellows of the Royal Meteorological Society a copy of that Part was forwarded to each Fellow of that Society.

THE SANITATION OF INDUSTRIES AND OCCUPATIONS.

A second course of free public lectures on the Sanitation of Industries and occupations, was arranged in the Autumn.

The subjects embraced in this second course were:—

"Coal Mining." SIMEON SNELL, F.R.C.S.EDIN., M.R.C.S.ENG. (Sheffield.)

"Quarrying of various kinds, Granite, Marble, Stone, Slate, Chalk and Limestone." C. LE NEVE FOSTER, D.SC., B.A., F.R.S., H.M. Inspector of Mines, Professor of Mining, Royal College of Science. (Llandudno.)

"Workers in Mercury, Phosphorus and Sulphur." T. EUSTACE HILL, M.B., B.SC., F.I.C., Medical Officer to the County Council of Durham.

"Chlorine and Chrome Compounds." D. J. O'NEIL, M.B., Certifying Factory Surgeon. (Farnworth.)

"Workers in Copper, Zinc, Brass and Tin." R. M. SIMON, B.A., M.D. (Birmingham.)

These Lectures being given free involved considerable expenditure on the part of the Institute, but the Council believe that much good

has been done, by spreading knowledge on subjects of such vital importance to the operative classes. The Lectures will be published in Part I. of the Journal for 1895, and will be very valuable for reference upon a subject upon which there is but little published information.

LECTURES FOR SANITARY OFFICERS AND STUDENTS.

The two usual courses of Lectures and Demonstrations for Sanitary Officers have been held in London during the year. The first course was held in February and March, for which 134 Students entered their names, the average attendance, including Members and Associates, being 112.

The Lectures comprised in this course were:—

1. } "Elementary Physics" (two Lectures). J. F. J. SYKES, D.SC.,
2. } M.D., Medical Officer of Health, St. Pancras.
3. "Ventilation, Warming, and Lighting," SIR DOUGLAS GALTON, K.C.B., D.C.L., LL.D., F.R.S.
4. "Principles of Calculating Areas, Cubic Space, &c.; Interpretation of Plans and Sections to Scale." H. LAW, M.INST.C.E.
5. "Water Supply, Drinking Water, Pollution of Water." J. WALLACE PEGGS, ASSOC.M.INST.C.E.
6. "Sanitary Building Construction." KEITH D. YOUNG, F.R.I.B.A.
7. "Sanitary Appliances." PROF. W. H. CORFIELD, M.A., M.D.OXON., Medical Officer of Health, St. George's, Hanover Square.
8. "Details of Plumbers' Work." J. WRIGHT CLARKE.
9. "House Drainage." W. C. TYNDALE, ASSOC.M.INST.C.E.
10. "Sewerage and Sewage Disposal." PROF. H. ROBINSON, M.INST.C.E.
11. "Scavenging, Disposal of House Refuse." CHARLES MASON, ASSOC.M.INST.C.E., A.R.I.B.A. Surveyor, St. Martin's-in-the-Fields.
12. "Diseases of Animals in relation to Meat Supply; Characteristics of Vegetables, Fish, &c., unfit for Food." PROF. A. WYNTER BLYTH, BARRISTER-AT-LAW, M.R.C.S., Medical Officer of Health, St. Marylebone.

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13. "Infectious Diseases and Methods of Disinfection." W. H. HAMER, M.A., M.D., D.P.H., Assistant Medical Officer of Health, County of London.

14. "Objects and Methods of Inspection." J. F. J. SYKES, D.SC., M.D., Medical Officer of Health, St. Pancras.

15. "Nature of Nuisances, including Nuisances the abatement of which is difficult." ARTHUR NEWSHOLME, M.D., D.P.H., Medical Officer of Health, Brighton.

16. "Trade Nuisances." PROF. A. BOSTOCK HILL, M.D., D.P.H.CAMB., F.I.C, Medical Officer of Health, Aston R.S.A.

17. "Sanitary Law. English, Scotch, and Irish; General Enactments, Public Health Act, 1875; Model Bye-Laws, &c. PROF. A. WYNTER BLYTH, BARRISTER-AT-LAW, M.R.C.S., Medical Officer of Health, St. Marylebone.

18. "Sanitary Laws and Regulations Governing the Metropolis." LOUIS PARKES, M.D., D.P.H.LOND., Medical Officer of Health, Chelsea.

At the second course, in October and November, 112 Students entered their names, the average attendance, including Members and Associates, being 113.

The Course was extended by adding two Lectures on Elementary Chemistry and one on Elementary Bacteriology.

The Lectures comprised in the second course were :—

1. 2. "Elementary Physics" (two Lectures). JOHN CASTELL-EVANS, F.I.C., Lecturer on Inorganic Chemistry and Chemical Physics at the City and Guilds of London Technical College, Finsbury.

3. 4. "Elementary Chemistry" (two Lectures). S. RIDEAL, D.SC.LOND., F.I.C., F.C.S., Public Analyst, Lewisham District Board of Works.

5. "Elementary Bacteriology." R. T. HEWLETT, M.D., M.R.C.S.

6. "Ventilation, Warming, and Lighting." SIR DOUGLAS GALTON, K.C.B., D.C.L., LL.D., F.R.S.

7. "Principles of Calculating Areas, Cubic Space, &c.; Interpretation of Plans and Sections to Scale." H. LAW, M.INST.C.E

8. "Water Supply, Drinking Water, Pollution of Water." J. WALLACE PEGGS, ASSOC.M.INST.C.E.

9. "Sanitary Building Construction." KEITH D. YOUNG, F.R.I.B.A.

10. "Sanitary Appliances." PROF. W. H. CORFIELD, M.A., M.D.OXON., Medical Officer of Health, St. George's, Hanover Square.

11. "Details of Plumbers' Work." J. WRIGHT CLARKE.

12. "House Drainage." W. C. TYNDALE, ASSOC.M.INST.C.E.

13. "Sewerage and Sewage Disposal." PROF. H. ROBINSON, M.INST.C.E.

14. "Scavenging, Disposal of House Refuse." CHARLES MASON, ASSOC.M.INST.C.E., A.R.I.B.A., Surveyor, St. Martin's-in-the-Fields.

15. "Diseases of Animals in relation to Meat Supply; Characteristics of Vegetables, Fish, &c., unfit for food." PROF. A. WYNTER BLYTH, BARRISTER-AT-LAW, M.R.C.S., Medical Officer of Health, St. Marylebone.

16. "Infectious Diseases and Methods of Disinfection." EDWARD C. SEATON, M.D., F.R.C.P., Medical Officer of Health, Surrey County Council.

17. "Objects and Methods of Inspection." J. F. J. SYKES, D.SC., M.D., Medical Officer of Health, St. Pancras.

18. "Nature of Nuisances, including Nuisances the abatement of which is difficult." ARTHUR NEWSHOLME, M.D., D.P.H., Medical Officer of Health, Brighton.

19. "Trade Nuisances." PROF. A. BOSTOCK HILL, M.D., D.P.H., CAMB., F.I.C., Medical Officer of Health, Aston R.S.A.

20. "Sanitary Law: English, Scotch, and Irish; General Enactments, Public Health Act, 1875; Model By-Laws, &c." PROF. A. WYNTER BLYTH, BARRISTER-AT-LAW, M.R.C.S., Medical Officer of Health for St. Marylebone.

21. "Sanitary Laws and Regulations Governing the Metropolis." LOUIS PARKES, M.D., D.P.H.LOND., Medical Officer of Health, Chelsea.

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Arrangements were made in connection with these Lectures for the Students to visit the places mentioned below. The names of the gentlemen who kindly arranged the visits and conducted the Students are also given:—

Aylesbury Dairy Co. J. A. HATTERSLEY, Managing Director.

Sewage and Destructor Works, Ealing. CHAS. JONES, M.INST. C.E., Engineer and Surveyor to the Local Board (2 visits).

Croydon Water Works and Beddington Sewage Irrigation Farm, Croydon. THOS. WALKER, M.INST.C.E., Borough Engineer.

Express Dairy Company's Farm, College Farm, Finchley, and Establishment. G. TITUS BARHAM, Managing Director.

Visits of Inspection at Mitcham. DR. DARRA MAIR (2 visits).

Hornsey Sanitary Depôt, Sewage Disposal Works, and Isolation Hospital. T. DE COURCY MEADE, M.INST.C.E., Engineer and Surveyor to the Local Board.

Wimbledon Sewage Works and Farm. C. H. COOPER, ASSOC. M.INST.C.E., Engineer and Surveyor to the Local Board.

Tripe Dressers. W. F. BURRILL.

Knacker Yard. HARRISON & BARBER (2 visits).

Soap Works. A. H. KNIGHTS.

Gut Scrapers. LINK & SONS.

East London Soap Works. E. COOK & CO.

St. Pancras Disinfecting Station, Disinfecting Apparatus, Destructor Furnace, Vans for Infected and Disinfected Clothing, Ambulance, Coach Houses, Stores for Disinfectants, &c., Family Shelter for Persons during Disinfection, Infectious Mortuary, General Mortuary, Poor Law Mortuary, Post Mortem Room and Coroner's Court. J. F. J. SYKES, D.SC., M.D., Medical Officer of Health (4 visits).

Guinness' Buildings and Disinfecting Station, Chelsea (2 visits). LOUIS PARKES, M.D., D.P.H.LOND., Medical Officer of Health.

St. George's, Hanover Square, Sanitary Works in different stages of progress, Disinfecting Station, Mortuary, &c., Model Dwellings (Gatliff Buildings), and Routine Office work of a Sanitary Inspector. A. TAYLOR, Chief Sanitary Inspector (4 visits).

East London Water Works, Lea Bridge. W. B. Bryan, M.INST.C.E., Engineer to the Company.

Friern Barnet Sewage Works. E. J. Reynolds, ASSOC.M.INST.C.E., Surveyor to the Local Board.

Barking Sewage Outfall Works. J. E. Worth, M.INST.C.E., District Engineer, L.C.C.

Southwark and Vauxhall Water Works, Hampton. J. W. Restler, M.INST.C.E., Engineer to the Company.

The Council would again call attention to the practical nature of these Inspections and Demonstrations, and the excellent opportunity they afford to the Students of becoming intimately acquainted with the duties that may subsequently fall upon them. Much care is exercised in the selection and organisation of the visits in order to obtain this end.

The Students have the free use of the Library and Museum at all times when they are open, and a special time is set apart each week for the Students to examine the Museum with the assistance of the Curator.

For the convenience of those Students who wish to borrow books for home reading, special arrangements have been made for the loan to them, at a small fee, of books from Lewis' Medical and Scientific Library, which contains a large number of recent text books and standard Sanitary works. This arrangement is also available for Members and Associates of the Institute.

PROVINCIAL LECTURES.

Arrangements were made in conjunction with the County Councils or Corporations for Courses of Lectures to Sanitary Officers at the following Towns :—

The County Council and the Town Council of Nottingham	Nottingham.
The Technical Instruction Committee of the Corporation of Liverpool	Liverpool.
The Technical Education Act Committee of the Corporation of Cardiff	Cardiff.

186 Students entered their names for these Lectures. The average attendance, including Members and Associates of the Institute, being about 70 at each Lecture.

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The courses at the various centres consisted of the following Lectures:

NOTTINGHAM.

1. Introductory: "Ventilation, Warming and Heating." SIR DOUGLAS GALTON, K.C.B., D.C.L., LL.D., F.R.S.
2. "Methods of Measuring Areas, Cubic Space, &c.; The Interpretation of Plans." HENRY LAW, M.INST.C.E.
3. "Soils and Sub-soils, with reference to their suitability for Building Purposes." M. J. R. DUNSTAN, M.A., F.R.S.E., F.I.C.
4. "Plumbers' Work." A. H. SIMPSON, F.R.MET.SOC., University College, Nottingham.
5. "House Drainage, Sanitary Appliances and Domestic Sanitation." PHILIP BOOBBYER, M.B., Medical Officer of Health, Nottingham.
6. "Systems of Sewerage and Sewage Disposal." ARTHUR BROWN, M.INST.C.E., Borough Engineer, Nottingham.
7. "Scavenging, and Disposal of Refuse in Town and Country.' HARVEY LITTLEJOHN, M.A., M.B., Medical Officer of Health, Sheffield.
8. "Duties and Powers of Sanitary Inspectors: in (*a*) Urban Districts; (*b*) Rural Districts." GEORGE REID, M.D., Medical Officer of Health, Staffordshire County Council.
9. "Infectious Diseases and their Prevention, Disinfection." J. PRIESTLEY, B.A., M.D., D.P.H., Medical Officer of Health, Leicester.
10. "Diseases of Animals affecting Man through Food Supplies, &c." ALFRED HILL, M.D., Medical Officer of Health, Birmingham.
11. "Sanitary Law, General Enactments, Public Health Act, 1875, Model Bye-Laws, &c." Professor A. WYNTER BLYTH, Barrister-at-Law, Medical Officer of Health, St. Marylebone.
12. "Water Supply, Drinking Water, Pollution of Water." B. A. WHITELEGGE, M.D., B.SC., D.P.H., Medical Officer of Health, West Riding County Council.

In connection with the Lectures, arrangements were made for the Students to visit the Sewage Works and Farm, Sanitary Wharf, Cattle Market and Slaughter-House, Trade Premises (offensive trades), Chemical Works, Public Baths, Disinfecting Stations, Model Lodging Houses, &c.

LIVERPOOL.

1. "Introductory, and on Ventilation, Heating and Lighting. LOUIS PARKES, M.D., D.P.H., Medical Officer of Health, Chelsea.
2. "House Drainage and Sanitary Appliances." H. PERCY BOULNOIS, M.INST.C.E., City Engineer, Liverpool.
3. "Sanitary Building Construction." T. HARNETT HARRISSON, ASSOC.M.INST.C.E., F.R.I.B.A.
4. "Defects in Plumbers' Work." COARD S. PAIN, F.S.I., ASSOC. INST.C.E.
5. "Scavenging and Disposal of Refuse." E. G. MAWBEY, ASSOC.M.INST.C.E.. Borough Surveyor, Leicester.
6. "Water Supply, Drinking Water, Pollution of Water." JOSEPH PARRY, M.INST.C.E.
7. "Diseases of Animals in relation to Meat Supply: Characteristics of Vegetables, Fish, &c., unfit for Food." FRANCIS VACHER, F.R.C.S., F.C.S., Medical Officer of Health, Cheshire County Council.
8. "Infectious Diseases and Methods of Disinfection." H. E. ARMSTRONG, D.HYG., M.R.C.S., Medical Officer of Health, Newcastle-upon-Tyne.
9. "Powers and Duties of Sanitary Inspectors: Nuisances and Offensive Trades." PHILIP BOOBBYER, M.B., M.R.C.S., Medical Officer of Health, Nottingham.
10. "Objects and Methods of Inspection." E. W. HOPE, M.D., D.SC., Medical Officer of Health, Liverpool.
11. "Principles of Calculating Areas, Cubic Space, &c.; Intrepretation of Plans and Sections to Scale." W. GOLDSTRAW, Surveyor of Buildings, Liverpool.
12. "Sanitary Law, General Enactments, Public Health Act, 1875, Model Bye-Laws, &c." Prof. A. WYNTER BLYTH, Barrister-at-Law, Medical Officer of Health, St. Marylebone.

In connection with the Lectures, arrangements were made for Inspections and Demonstrations for the Students at the following works, selected as being illustrative of Sanitary practice and administration:—Lodging-House, Disinfecting Stations, Cellar Dwellings, Abattoirs, Infectious Hospitals, Baths, Wash-Houses, Mortuary (Princes Dock), Artizans' and Labourers' Dwellings, and Refuse Destructor. A Special visit was also arranged to the Health Exhibition, which included an Explanatory Lecture upon the Exhibits by H. PERCY BOULNOIS, M.INST.C.E.

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CARDIFF.

1. Introductory. THOMAS JONES DYKE, F.R.C.S., Medical Officer of Health, Merthyr Tydfil.
2. "Ventilation, Warming and Lighting." P. RHYS GRIFFITHS, M.B., B.SC.LOND.
3. "House Drainage and Sanitary Appliances. Details of Plumbing." H. W. WILLS, Architect, Swansea, and J. E. KNOWLES, R.P., Cardiff.
4. "Infectious Diseases and Methods of Disinfection." EDWARD WALFORD, M.D., D.P.H.CAMB., Medical Officer of Health, Cardiff.
5. "Diseases of Animals in relation to Meat Supply. Characteristics of Articles unfit for Food." FRANCIS VACHER, F.R.C.S., Medical Officer of Health, Cheshire County Council.
6. "Water Supply. Drinking Water. Pollution of Water." P. RHYS GRIFFITHS, M.B., B.SC.LOND.
7. "Sanitary Building Construction." EDWIN SEWARD, F.R.I.B.A.
8. "Scavenging and Disposal of Refuse." W. WILLIAMS, M.A., M.B., D.P.H., Medical Officer, Glamorgan County Council.
9. "Principles of Calculating Areas, Cubic Spaces. Interpretation of Plans." EDWIN FOSTER, Chief Engineering Assistant to the Borough Engineer, Cardiff.
10. "General Powers and Duties of Sanitary Inspectors." EDWARD WALFORD, M.D., D.P.H.CAMB., Medical Officer of Health, Cardiff.
11. "Objects and Methods of Inspection and Enquiry." W. WILLIAMS, M.A., M.B., D.P.H., Medical Officer, Glamorgan County Council.
12. "Sanitary Law. Model Bye-Laws."
13. "Nuisances and Offensive Trades." W. WILLIAMS, M.A., M.B., D.P.H., Medical Officer, Glamorgan County Council.
14. "Port Sanitary Work." EDWARD WALFORD, M.D., D.P.H.CAMB., Medical Officer of Health, Cardiff.

The Council desire to record their sincere thanks to the Lecturers both in London and the provinces for the great benefits they have conferred upon the Students, and for the assistance they have given to the diffusion of Sanitary knowledge, by the preparation and delivery of these Lectures, and also to those who have taken much trouble to make the various visits instructive to the Students.

EXAMINATIONS.

For Local Surveyors.

During the year only one open Examination has been held, as the Council had decided to discontinue these Examinations, but in order to give the Candidates their privilege of a second trial, an adjourned Examination was held for those Candidates only who had failed to pass. At this Examination 35 Candidates presented themselves, and (including those who passed at the adjourned Examination), 24 received Certificates of competency as regards their Sanitary knowledge to discharge their duties as Local Surveyors.

For Sanitary Inspectors.

Examinations were held at the following places:—

London (2 Examinations).	Plymouth.
Nottingham.	Norwich.
Durham.	Birmingham.
Bristol.	Cardiff.
Hull.	Liverpool.

At these Examinations 477 Candidates presented themselves, and 255 were certified competent, as regards their Sanitary knowledge, to discharge the duties of an Inspector of Nuisances under the Public Health Act, or of a Sanitary Inspector under the Public Health London) Act.

Since these Examinations were first established 102 have been held, 35 for Local Surveyors, and 67 for Inspectors of Nuisances, and 3103 Candidates have been examined, of whom 142 have passed the Examination for Local Surveyors, and 1635 that for Inspectors of Nuisances.

CONGRESS AND EXHIBITION.

The Congress was held in the City of Liverpool under the Presidentship of Sir Francis Sharp Powell, Bart., M.P., and was one of the most successful the Institute has ever held.

Excellent rooms in the University College were placed at the disposal of the Institute for the various meetings. Delegates to the Congress were appointed by the Russian Government, by 200 Sanitary Authorities, and by 25 Societies and Associations. The Congress was attended by 480 Delegates; 400 Members and Associates of the Institute; 184 Associates of the Congress; making a total of 1064. Many very valuable papers were contributed to the meeting and have been published in the Journal.

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The Health Exhibition was held in the Drill Hall, Upper Warwick Street, and was open twenty-four days. It was attended by 48,189 visitors. A list of the Exhibits, to which medals and certificates were awarded, is given in Part III. of the Journal for 1894, and also a list of certain Exhibits which required special tests in London or elsewhere before their merits could be decided upon by the Judges.

An interesting feature in the Exhibition at Liverpool was the Science room, in which lectures were given twice daily on Bacteriology and General Sanitation, illustrated by lantern views. A very interesting display of bacteriological cultivation and apparatus was arranged and demonstrated by Prof. Boyce, of Liverpool University, who courteously devoted a very large amount of time to this work.

It may be mentioned that an illustrated list of the Exhibits to which awards have been given by the Institute at various Exhibitions is published, and forms a useful and reliable guide in the selection of Sanitary apparatus and appliances.

SANITARY LEGSILATION.

Several Bills relating to Public Health were laid before Parliament during the year; very few of these became Law, but the Parliamentary Committee of the Institute reported fully to the Council upon them all.

The following is a list of these measures, with a note as to their object and any action taken by the Council:—

London Streets and Buildings Bill. Drawn up by the London County Council.

An important Bill to consolidate and amend the enactments relating to streets and buildings in London.

The Council sent a number of observations on certain clauses to the County Council, and after considerable discussion and amendment in Parliament, this Bill received the Royal Assent.

Plumbers' Registration Bill. Brought in by Mr. Knowles, Sir Algernon Borthwick, Earl Compton, Mr. Dixon, Dr. Farquharson, Mr. Bowen Rowlands, and Mr. Sexton.

This Bill, which was first introduced in 1892, was again brought forward. The Council petitioned against this Bill, on account of certain objectionable clauses, and it was eventually withdrawn.

Foreign Meat Bill. Brought in by Mr. George Lambert, Mr. Yerburgh, Dr. Farquharson, Sir John Kennaway, and Mr. Billson.

A Bill to regulate the sale of Foreign Meat, in order that the public may know what meat they are purchasing, and that the producer of British Meat may not be unduly interfered with by the sale of Foreign Meat as British Meat.

The Council petitioned in favour of this Bill, but the Bill was eventually dropped.

Sale of Food and Drugs Act (1875) *Amendment.* Brought in by Sir Charles Cameron, Mr. Frederick Frye, Mr. Kearley, Dr. Farquharson, and Mr. Channing.

A Bill to amend the sale of the Food and the Drugs Act, 1875, and the Margarine Act, 1887.

The Council approved of the general principles of the Bill, but decided to take no action in regard to it, and the Bill was eventually withdrawn.

Factories and Workshops Bill. Brought in by Mr. Secretary Asquith, Mr. Herbert Gladstone, and Mr. George Russell.

A Bill to amend and extend the Law relating to Factories and Workshops.

The Council petitioned in favour of the Bill, and also sent copy of the amendments which appeared to them desirable, relating principally to questions of ventilation, and suggesting the inclusion of restaurants, and places in which food is prepared or stored for the purposes of being sold. The Bill was eventually withdrawn.

Working Men's Dwellings Bill. Brought in by Mr. Wrightson, Sir John Gorst, Mr. James Lowther, Sir Alfred Hickman, Mr. Jesse Collings, Mr. Graham, and Mr. Bartley.

A Bill to give facilities for the acquisition by working men of their own dwelling houses.

No action was taken with reference to this Bill, and it was eventually dropped.

Infectious Disease (Notification) Bill. Brought in by Mr. Bolitho, Mr. Courtney, Mr. Henry Hobhouse, and Mr. Mallock.

A Bill to extend the operation of the Infectious Disease (Notification) Act, 1889.

The Council decided to petition in favour of this Bill, but it was dropped before the petition could be presented.

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West Riding Rivers Conservancy Bill. Brought in by Right Hon. W. L. Jackson and Sir Frederick Mappin, Bart.

A Bill to make more effectual provision for preventing the pollution of the rivers of the West Riding of Yorkshire and their tributaries.

The Council petitioned in favour of this Bill, and it received the Royal Assent.

Compulsory Vaccination Abolition Bill. Brought in by Mr. Hopwood, Mr. Channing, Mr. Byles, and Dr. Clark.

A Bill to abolish the compulsion to vaccinate.

The Council considered that as the Royal Commission had not yet presented its report, the introduction of any Bill, either in support of or against compulsory vaccination, was inopportune, and decided to petition against the Bill. It was eventually dropped.

Housing of the Working Classes Bill. Brought in by Mr. Stern, Mr. Channing, Mr. Logan, and Mr. H. L. W. Lawson.

A Bill for facilitating the operation of the Housing of the Working Classes Act, 1890, in as far as it relates to Rural Sanitary Districts.

The Council petitioned in favour of this Bill, but it was eventually dropped.

Rivers Pollution Prevention Bill. Brought in by Sir Francis Sharp Powell, Mr. Henry Hobhouse, Sir John Dorington, Mr. Barran, Sir Henry Howarth, and Dr. Farquharson.

A Bill to make more effectual provision for prevention of the pollution of rivers and streams.

The Council petitioned in favour of this Bill, it was however withdrawn.

Contagious Diseases (Animals) Bill, changed to Diseases of Animals. Brought in by Mr. Herbert Gardner, the Attorney-General, and the Lord Advocate.

A Bill to consolidate, with amendments, the Contagious Diseases (Animals) Acts, 1878 to 1893.

The Council petitioned in favour of the Bill, and the Bill received the Royal Assent on Aug. 25th, 1894.

PARKES MUSEUM.

Several new and interesting exhibits have been added during the year, and the extensive use which is made of the Museum shows the growing appreciation of it by teachers and students.

The total number of Visitors during the year is estimated at about 20,000.

Forty-eight classes by special appointment visited the Museum from various public and private institutions, numbering 865 students.

The following is a list of the principal institutions represented.

Addey's School, Deptford.
Architectural Association.
Certificated Sanitary Inspectors' Association.
Charing Cross Hospital.
Charterhouse School of Science.
City & Guilds of London Institute.
Essex Technical Institute.
Exeter Hall, Y.M.C.A.
Green Coat National School.
Kinder Garten College, Stockwell.
King's College, London.
London Hospital.
Maria Grey Training College.
National Health Society.
North-East London Institute.
People's Palace, Mile End.
Physical College, Hampstead.
Polytechnic, Regent St.
Queen Victoria's Jubilee Nurses Institute.
St. Bartholomew's Medical School.
St. Catherine's College, Tottenham.
St. George's Hospital.
St. Thomas' Hospital.
University College.
Westbourne Park Institute.
Westminster Teachers' Association.
West Sussex Institute.
William St. Board Schools.

The extension of premises and removal of Library and Offices to No. 72, Margaret Street, rendered available a considerable amount of space which is being utilised by the Committee to extend and develop Division A, "Science in relation to Hygiene," by which means the teaching value of the Museum will be largely augmented.

LIBRARY.

During the year there have been 920 readers. 317 volumes and pamphlets have been presented to the Library since last report. A List of these is published in Vol. XV. of the Journal.

The increased accommodation afforded by the new premises, and the greater facilities for reading and reference, make the Library much more convenient for Members and Students than previously.

The Library contains, besides recent Text Books and Works on Hygiene and Sanitation, Extensive Sets of Blue Books and Official

[redacted]

Reports. The Council will always be glad to receive old Official Reports which may be used in completing these sets. They will also be glad to receive recently published books.

JOURNAL.

The Transactions of the Institute for the year 1894 have been published in the form of a Quarterly Journal, which has proved very successful. It enables the Council to place the records of the various meetings in the hands of the members at an early date, and also affords a means of calling attention to matters of interest relating to the Institute. In addition to the Transactions of the Institute, the Council have included in the Journal other contributions of sanitary interest. The Journal for the year is considerably larger than the previous volumes of the Transactions, and the number issued has also largely increased.

EPITOME OF REGISTERS OF MEMBERS AND ASSOCIATES.

	Hon. Fellows.	Fellows.	Members.	Associates.	Total.
Dec. 31, 1893	23	144	497	655	1319
Elected	+2	+10	+88	+204	+304
Transferred	—	—	–10	–7	–17
Resigned	—	—	–17	–3	–20
Erased	—	—	–6	–46	–52
Died	—	–2	–5	–5	–12
Dec. 31, 1894	25	152	547	798	1522

It is with much regret that the Council have to report the death of R. R. Carew and S. W. North, M.R.C.S., *Fellows*. Samuel Hill, A.R.I.B.A., Bowes Scott, Allan Stewart, Dr. Henry Welch, B.Sc., and J. B. Mitchell Withers, F.R.I.B.A., *Members*. John Gibson, D. Nicholas, W. L. Puddle, J. Rains, and Alfred Wood, *Associates*.

FINANCE.

The statement of Income and Expenditure bears witness to the steady increase in the growth of the Institute. The accounts show a great improvement on those for 1893, but the receipts are not yet quite equal to the expenditure. It will be seen however by excluding the Receipts and Expenses connected with the Congress and Exhibition, held in 1894, so as to make the accounts comparable with those of 1893, that the normal Income is increasing more rapidly than the normal Expenditure, notwithstanding the enlargement of the

premises, and the Council hope that by careful regulation of the finances this improvement will continue.

As will be seen by reference to the General Balance Sheet, the Investment in Consolidated Stock is now only £8,248 11s. 1d., whereas in 1893 it was £9,248 11s. 1d.; the difference is due to the sale of £1,000 of Stock authorised by the Extraordinary General Meeting held in July, 1894. This money has been expended on the purchase of the Lease, and the adaptation and furnishing of the new premises.

	£	s.	d.
The cost of the Lease was	£200	0	0
Drainage, Furnishing, Lighting, &c. ..	633	5	11
	£833	5	11

Leaving a Balance of £166 14s. 1d., which is included in the Cash at the Bankers stated in the General Balance Sheet.

EPITOME OF THE WORK OF THE INSTITUTE, 1894.

	London Lectures and Examinations.	Total Attendance.
4	Sessional Meetings for the discussion of Sanitary subjects	586
4	Lectures to Ladies on Domestic Hygiene	527
1	Address on Domestic Hygiene..	100
6	Lectures on Meteorology	264
5	Lectures on the Sanitation of Industries..	239
39	Lectures to Sanitary Officers	4363
28	Practical Demonstrations for Sanitary Officers	967
1	Examinations Local Surveyors..	35
2	Examinations Sanitary Inspectors	238
48	Classes brought to Museum	865
	Other persons visiting the Museum..	13,056
	Provincial Lectures and Examination.	
38	Lectures to Sanitary Officers	2666
9	Examinations Sanitary Inspectors	239
	Provincial Congress and Exhibition.	
3	Sectional Meetings	520
5	Conferences	897
3	Addresses and Lectures	1900
	Exhibition, open for four weeks, at which a number of Lectures were given	48,189

ERNEST TURNER,
Chairman of Council.

E. WHITE WALLIS,
Secretary.

March, 1895.

STATEMENT OF INCOME AND EXPENDITURE connected with Exhibition at Liverpool, 1894.

Dr.

Expenditure.	£	s.	d.
To Printing, Postage and Advertising	323	3	5
„ Catalogues and Programmes	222	4	1
„ Bands and Entertainments	233	12	8
„ Lectures	38	6	0
„ Curator's Salary and Expenses	200	4	6
„ Wages	206	0	7
„ Incidental Expenses	114	13	3
„ Buildings, Fittings and Decorations	206	19	10
„ Judging Expenses (Partly Estimated)	301	0	3
„ Gas, Water and Electric Lighting	16[illegible]	9	10
	2008	14	5
„ Balance	513	14	9
	£2522	9	2

Cr.

Income.	£	s.	d.
By Rent for Space	1092	14	8
„ Admissions	1016	4	6
„ Catalogues and Programmes	300	17	0
„ Fees for further Trials	10	10	0
„ Gas, Water and Electric Lighting	102	3	0
	£2523	9	2

Examined with the Books and Accounts and found correct,

March 6th, 1895.

Alfred Lass, Wood & Co., Chartered Accountants, } *Auditors.*
Magnus Ohren, Assoc.M.Inst.C.E., }

STATEMENT of INCOME and EXPENDITURE

Dr.

Expenditure.	£	s.	d.	£	s.	d.
To Rent, Rates, Taxes, and Insurance	397	13	1			
„ Salaries and Wages	1,004	14	1			
„ Coals, Lighting, and Care of Offices......	76	4	8			
„ Repairs and Alterations (Museum)	70	17	2			
„ Maintenance of Museum.....................	65	5	9			
„ Library, Binding, &c.	18	2	2			
„ Postage and Carriage	149	4	0			
„ Printing and Stationery	198	15	4			
„ Advertising	4	19	0			
„ Incidental Expenses...........................	82	14	8			
„ Law Charges	3	3	0			
„ Depreciation of Leaseholds.................	66	6	3			
				2,137	19	2
To Journal and Publications, Cost of Printing, &c., less Sales and Advertisements	334	18	7			
„ Sessional Meetings	25	19	5			
„ Lectures, Sanitary Officers	221	9	11			
„ „ Sanitation of Industries	37	19	5			
„ „ Domestic Hygiene	56	16	10			
„ „ Meteorological	39	4	2			
„ Examinations......................................	1,143	12	7			
„ Congress	432	3	1			
„ Illustrated List of Premiated Exhibits...	19	6	8			
				2,311	10	8
				£4,449	9	1

	£	s.	d.	£	s.	d.
To Expenditure on New Premises (exclusive of purchase of Lease)	587	3	11			
„ Extension of Museum	46	2	0			
				633	5	11
„ Balance for the year 1894 brought down				172	1	11
				805	7	10
„ Balance to be carried forward				9,260	16	8
				£10,066	4	6

Examined with the Books and Accounts and found correct,

ALFRED LASS, WOOD & CO., Chartered Accountants, } *Auditors.*
MAGNUS OHREN, ASSOC.M.INST.C.E,

March 6*th*, 1895.

[redacted]

for the Year ended 31st December, 1894.

Cr.

Income.	£	s.	d.	£	s.	d.
By Annual Subscriptions	1,012	2	2			
„ Entrance Fees	90	6	0			
„ Fellowship Fees	42	0	0			
„ Donations	2	2	0			
„ Interest on Investments	239	14	11			
„ Profit on Sale of Consols	41	4	0			
				1,427	9	1
„ Lectures, Sanitary Officers	291	4	6			
„ „ Domestic Hygiene	53	0	0			
„ „ Meteorological	25	17	5			
„ Examinations	1,859	15	9			
„ Publications — Farr's and Simon's — Profit on Sales	3	4	9			
„ Balance of Exhibition Account	513	14	9			
„ Congress	96	10	9			
„ Illustrated List of Premiated Exhibits	6	10	11			
				2,849	18	10
				4,277	7	11
„ Balance, excess of Expenditure over Income for the year 1894, carried down				172	1	11
				£4,449	9	10

	£	s.	d.
By Balance brought forward from last account (1893)	10,066	4	6
	£10,066	4	6

GENERAL BALANCE SHEET,

Liabilities.	£	s.	d.
To Subscriptions paid in advance for 1895	46	4	0
„ Examination Fees „ „	32	0	0
„ Life Composition Fund	199	10	0
„ Library Catalogue Account...............	142	14	6
„ Sundry Creditors	810	11	10
	1,231	0	4
„ Balance of Assets over Liabilities...............	9,260	16	8
	£10,491	17	0

Examined with the Books and Accounts and found correct,

ALFRED LASS, WOOD & Co., Chartered Accountants, } *Auditors.*
MAGNUS OHREN, ASSOC.M.INST.C.E, }

March 6*th*, 1895.

[redacted]

31st DECEMBER, 1894.

Assets.	£	s.	d.	£	s.	d.
By Leases of Premises	477	17	5			
„ Library and Contents of Museum, estimated value.............................	500	0	0			
„ Furniture and Fixtures, estimated value	100	0	0			
„ Journals and Publications, estimated value	772	9	3			
„ Farr's Works, estimated value	18	15	0			
„ Simon's „ „ „	98	0	0			
				1,967	1	8
„ Sundry Debtors—						
Members' Subscriptions in Arrear...	138	12	0			
Fellowship Fees „ ...	5	5	0			
Entrance „ „ ...	37	16	0			
Amount due on account of Provincial Lectures, &c.	108	12	9			
				290	5	9
„ Cash in hand	29	2	1			
„ „ at Bankers on Deposit	178	10	0			
				207	12	1
„ Investment (£8,248 11s. 1d. Consolidated Stock) valued at cost				8,026	17	6
				£10,491	17	0

EXAMINATION IN PRACTICAL SANITARY SCIENCE.

MANY persons who have no intention of becoming Sanitary Officers, have expressed a desire to obtain a Certificate from The Sanitary Institute indicating their knowledge of Sanitary Science, and the Council have, therefore, thought it desirable to arrange a modified syllabus, which, although not including many technical subjects that an Inspector is required to know, goes beyond the scope of the present Inspectors' Examination as far as relates to Practical Sanitation. The Examination is arranged so as to be suitable for Foremen of Works, Builders and those engaged in allied Trades, Managers of Property, Teachers, and Lecturers, and others requiring a thorough knowledge of practical Sanitary Science.

Candidates who intend to present themselves for Examination in London on May 3rd and 4th, 1895, will have the option of selecting whether they will be examined under the Syllabus for Sanitary Inspector or under the following Syllabus for the Examination in Practical Sanitary Science:—

ELEMENTARY PHYSICS AND CHEMISTRY, in so far as they apply to Sanitary Science.

LOCAL CONDITIONS.

WATER.

MATERIALS AND CONSTRUCTION.

PRINCIPLES OF CALCULATING AREAS.

CUBIC SPACE, INTERPRETATION AND DRAWING OF PLANS AND SECTIONS TO SCALE.

VENTILATION, LIGHTING, AND WARMING.

DRAINAGE, SEWERAGE, AND SANITARY APPLIANCES.

SANITARY LAW, as far as is requisite to be known by the head of a household.

REGULATIONS.

Every Candidate is required to give two weeks' notice previous to presenting himself for Examination, and to furnish the Board of Examiners with satisfactory testimonials as to age and personal character. He must be able to write legibly and spell correctly.

No one under 21 years of age is admitted to the Examination.

The fee payable for the Examination is £3. 3s., which must be paid to the Secretary; 10s. 6d. on making application, and the remainder at least one week before the day of Examination. On the receipt of the fee, a ticket will be forwarded admitting to the Examination.

A Certificate bearing the Seal of the Institute, but quite different from the Certificate for Sanitary Inspectors, will be granted to each successful Candidate.

Any person having passed the Examination and received the Certificate is, by virtue of having such Certificate, upon proposal and election as Member of the Institute, exempt from payment of the Entrance Fee, and will be called upon to pay only the reduced subscription of £1 1s. annually.

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MEETINGS HELD JANUARY TO MARCH, 1895.

Sessional Meetings.

A Meeting was held on February 13th, at 8 p.m., when a discussion was opened by G. V. Poore, M.D., F.R.C.P., on "Dry Methods of Sanitation," Sir Thomas Crawford, K.C.B., LL.D., F.R.S., M.D., in the Chair. About 120 Members, Associates, and Visitors attended.

On March 13th, at 8 p.m., a discussion was opened by James Niven, M.B., M.A., M.O.H. Manchester, on "Back-to-Back Houses," with illustrations of various types of back-to-back houses met with in practice, and the methods adopted for dealing with this class of property by Thomas de Courcy Meade, M.Inst.C.E., City Surveyor, Manchester; Sir Francis Sharp Powell, Bart., M.P., in the Chair. About 128 Members, Associates, and Visitors attended. Both the papers and discussion will be published in Part 2, Vol. XVI.

Lectures and Demonstrations to Sanitary Officers.

The nineteenth course of 24 Lectures and 14 practical Demonstrations and Visits of Inspection to trade premises, Refuse Disposal Works, &c., commenced on February 1st and will be continued up to April 27th. A list of these is given in the Calendar published in Part 4, Volume XV. 125 students have entered their names for this course.

Examinations.

Examinations for Inspectors of Nuisances were held in the following towns:—

Bristol, February 15th and 16th. 16 candidates presented themselves and 10 were certified to be competent as regards their sanitary knowledge to discharge the duties of Inspectors of Nuisances.

Newcastle-upon-Tyne, March 15th and 16th. 21 candidates presented themselves and 15 were certified to be competent as regards their sanitary knowledge to discharge the duties of Inspectors of Nuisances.

CALENDAR, APRIL TO JUNE, 1895.

Council Meetings are held Monthly on the Second Wednesday in each Month.

Finance Committee	Second Wednesday.
Exhibition Committee	First Monday.
Congress and Editing Committee . . .	Second Monday.
Education Committee	Third Monday.
Museum Committee	Fourth Monday.

APRIL.

2 T. Lecture to Ladies. Domestic Hygiene (Earth), 3 p.m., by A. T. Schofield, M.D.

2 T. Lecture to Sanitary Officers, London, 8 p.m. Sanitary Building Construction, by Prof. T. Roger Smith, F.R.I.B.A.

3 W. Inspection and Demonstration at Chelsea, 3 p.m.

3 W. Sessional Meeting, 8 p.m. Combined Drainage, by J. F. J. Sykes, D.SC., M.D., and W. N. Blair, ASSOC.M.INST.C.E.

5 F. Lecture to Ladies. Domestic Hygiene (Water), 3 p.m., by A. T. Schofield, M.D.

5 F. Lecture to Sanitary Officers, London, 8 p.m. Sanitary Appliances, by Professor W. H. Corfield, M.A., M.D.

5 F. } 6 S. } Examination for Sanitary Inspectors, Southampton.

6 S. Inspection and Demonstration at East Surrey Water Works, Kenley, &c.

6 S. Lecture to Sanitary Officers, Norwich, 2 p.m. Sanitary Law, General Enactments, Public Health Act (1875), Model Bye-Laws, by H. Manley, M.A., M.B., D.P.H.

9 T. Lecture to Sanitary Officers, London, 8 p.m. Details of Plumber's Work, by J. Wright Clarke.

10 W. Inspection and Demonstration at St. George's, Hanover Square, W., 3 p.m.

12 F. *Good Friday.*

15 M. *Easter Monday.*

19 F. Lecture to Sanitary Officers, London, 8 p.m. Infectious Diseases and Methods of Disinfection. E. C. Seaton, M.D., F.R.C.P.

20 S. Inspection and Demonstration at Barking Sewage Outfall Works, 3 p.m.

20 S. Lecture to Sanitary Officers, Norwich, 2 p.m. Powers and Duties of Sanitary Inspectors, by H. Cooper Pattin, M.A., M.B., D.P.H.

23 T. Lecture to Sanitary Officers, London, 8 p.m. Sewerage and Sewage Disposal, by Prof. Henry Robinson, M.INST.C.E.

24 W. Inspection and Demonstration at St. Pancras, 3 p.m.

26 F. Lecture to Sanitary Officers, London, 8 p.m. Scavenging Disposal of House Refuse, by H. Percy Boulnois, M.INST.C.E.

[redacted]

27 S. Inspection and Demonstration at Sewage and Destructor Works, Ealing, 2.15 p.m.

27 S. Lecture to Sanitary Officers, Norwich, 2 p.m. Nuisances and Offensive Trades. J. C. Thresh, D.SC., M.B.

MAY.

3 F. } 4 S. } Examination for Sanitary Inspectors, London.

3 F. } 4 S. } Examination in Practical Sanitary Science, London.

4 S. Lecture to Sanitary Officers, Norwich, 2 p.m. Objects and Methods of Inspection, by J. F. J. Sykes, D.SC., M.D.

11 S. Lecture to Sanitary Officers, Norwich, 2 p.m. Diseases of Animals in relation to Meat Supply, &c. Prof. A. Wynter Blyth.

18 S. Lecture to Sanitary Officers, Norwich, 2 p.m. Infectious Diseases and Methods of Inspection, Bushell Anningson, M.A., M.D.

25 S. Lecture to Sanitary Officers, Norwich, 2 p.m. Principles of Calculating Areas, Cubic Space, &c. E. J. Silcock, ASSOC.M.INST.C.E.

JUNE.

8 S. Lecture to Sanitary Officers, Norwich, 2 p.m. Water Supply, Drinking Water, Pollution of Water, by Prof. W. H. Corfield, M.A., M.D.

14 F. } 15 S. } Examination for Sanitary Inspectors, Leicester.

15 S. Lecture to Sanitary Officers, Norwich, 2 p.m. Sanitary Building Construction, by Keith Young, F.R.I.B.A.

22 S. Lecture to Sanitary Officers, Norwich, 2 p.m. House Drainage and Sanitary Appliances, by W. C. Tyndale, ASSOC.M.INST.C.E.

29 S. Lecture to Sanitary Officers, Norwich, 2 p.m. Scavenging Disposal of Refuse and Sewage, by Arthur E. Collins, ASSOC.M.INST. [C.E.

MEMBERS AND ASSOCIATES ELECTED.

From JANUARY to MARCH, 1895, inclusive.

MEMBERS (MEM. SAN. INST.)

† Passed Examination as Local Surveyor.

‡ Passed Examination as Inspector of Nuisances.

[illegible] 1895. Feb. BAYLEY, William Thomas, ASSOC.M.INST.C.E., *Warminster, Wilts.*

[illegible] 1895. Jan. †BLACKBURN, Arthur William, 35, *Cannon St., E.C.*

[illegible] 1895. Jan. BRADSHAW, Surg. Lieut.-Col. R. Bradshaw, L.R.S.I.C., M.R.C.P.I., C.M., *Carrick-on-Shannon, Ireland.*

[illegible] 1895. Mar. BUTLER, Walter, 22, *Northumberland Road, Dublin.*

[illegible] 1895. Feb. CAIRNCROSS, Thomas Wilson, ASSOC.M.INST.C.E., *City Engineer, Cape Town.*

[illegible] 1895. Feb. FINGLAH, Frederick James, *Borough Engineer and Surveyor's Office, Cambridge.*

900 1895. Mar. Grant, Surg.-Capt. Allan Ewen, M.B., C.M., *Madras, India.*

886 1895. Jan. ‡†Hutton, John, 22*a*, *Highgate, Kendal.*

892 1895. Feb. ‡Latham Frank, STUD.INST.CE., *Westbourne House, Canterbury Road, Margate.*

887 1895. Jan. ‡†Lawson, Archibald, *Baker Street, Weybridge.*

888 1895. Jan. McBeath, Alexander Gordon, ASSOC.M.INST.C.E., *District Council Offices, Sale, Cheshire.*

891 1895. Jan. Mitchell, Trafford, M.D., M.O.H., *Llandilo-Talybont, R.S.A., Argyll House, Gorsenor, Glamorgan.*

893 1895. Feb. Morris, George Edwin, ASSOC.M.INST.C.E., 27, *The Parade, Tredegarville, Cardiff.*

897 1895. Feb. ‡Pearce, Alfred, ASSOC.M.INST.C.E., 57, *Belsize Park, Hampstead, N.W.*

889 1895. Jan. †Syms, John William, 107, *Third Avenue, Harrow Road, W.*

895 1895. Feb. †Uren, Frederick Charles, 19, *Cornwall Terrace, Penzance.*

890 1895. Jan. ‡†Young, Frank Russell, 22, *Palmerston Road, Walthamstow.*

ASSOCIATES (Assoc. San. Inst.)

‡ Passed Examination as Inspector of Nuisances.

1033 1895. Jan. ‡Addiscott, William James, *Municipal Buildings, Plymouth.*

1034 1895. Jan. ‡Andrew, William John, 146, *Shirland Road, Paddington, W.*

1077 1895. Feb. ‡Andrews, E. H., *Southcote House, St. John's Wood Road, Bournemouth.*

1035 1895. Jan. ‡Baldwin, Edwin, 37, *Beaufort Road, South Tottenham.*

1082 1895. Feb. ‡Barnett, Miss Emily B., 11, *St. Petersburg Place, Bayswater, W.*

1036 1895. Jan. ‡Bennett, Samuel Barlow, 7, *Wellington Street, Burslem, Staffs.*

1054 1895. Jan. ‡Beveridge, James M., 32, *Coleridge Road, Crouch End, N.*

1055 1895. Jan. ‡Black, Miss Anne, 9, *Camden Grove, W.*

1056 1895. Jan. ‡Booth, Edward Henry, *Hainault Road, North Street, Romford.*

1037 1895. Jan. ‡Boulter, Alfred George, 4, *The Parade, New Eltham, S.E.*

1038 1895. Jan. ‡Bridges, Walter H., *Surveyor's Office, Lymington.*

1038 1895. Jan. ‡Cameron, Mrs. J. G., 2, *St. Lawrence Road, Notting Hill, W.*

1060 1895. Feb. ‡Casselden, Henry E., 50, *Albert Road, Penge, S.E.*

1039 1895. Jan. ‡Chapman, Harry, 82, *Palace Road, Bromley, Kent.*

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1099 1895. Mar. ‡Chapple, William Robert, 97, *Rodney Street, Swansea, Glam.*
1096 1895. Feb. ‡Charlton, Joseph, 24, *Milbank Crescent, Hartlepool.*
1093 1895. Feb. ‡Collins, Robert, 78, *Carisbrooke Road, Liverpool.*
1039 1895. Jan. ‡Cottrell, Fredk. R., 50, *Hatcham Park Road, New Cross, S.E.*
1040 1895. Jan. ‡Curry, William Frederick, 27, *Dene Row, Bates Cottages, Newcastle-on-Tyne.*
1072 1895. Feb. ‡Deane, Miss Ethel, 8, *Waverley Road, Sefton Park, Liverpool.*
1067 1895. Feb. ‡Dodd, Miss Alice Maud, *Kimberley*, 173, *Tulse Hill, S.W.*
1084 1895. Feb. ‡Drake, E., 1, *Minet Avenue, Harlesden, N.W.*
1100 1895. Mar. ‡Ducker, Philip James, 31, *George Street, Chester.*
1060 1895. Jan. ‡Dunn, Edmund Richard, 90, *Queen Street, Ramsgate.*
1041 1895. Jan. ‡Evans, Ernest Arthur, 13, *Jeffreys Road, Clapham, S.W.*
1091 1895. Feb. ‡Fenn, Thomas, *Shaw Cross, Dewsbury.*
1042 1895. Jan. ‡Forbes, Archibald Hamilton, *Adelaide House, West Green Road, Tottenham, N.*
1083 1895. Feb. ‡Ford, Joseph, 97, *Tideswell Road, Eastbourne.*
1043 1895. Jan. ‡Foster, Leonard, 2, *Rutland Road, Bedford.*
1101 1895. Mar. ‡Fox, Fred., 6, *Richmond Road, Cardiff, Glam.*
1065 1895. Feb. ‡Gass, Matthew, 107, *Englefield Road, Islington, N.*
1044 1895. Jan. ‡Gordon, Arthur Murray, 67, *Rectory Road, Stoke Newington, N.*
1045 1895. Jan. ‡Gray, Miss Jessy M. S., 126, *Clapham Park Road, S.W.*
1064 1895. Jan. ‡Green, Bernard, 42, *Warbeck Road, Shepherd's Bush, W.*
1088 1895. Feb. ‡Green, J. Singleton, *Fern Bank, Haslingden.*'
1086 1895. Feb. ‡Hardman, John, 14, *St. George's Road, Preston, Lancs.*
1046 1895. Jan. ‡Henderson, Arthur James, *Thames Ditton, Surrey.*
1078 1895. Feb. ‡Hilder, W. L., *Montrose, Holmesdale Road, Sevenoaks.*
1076 1895. Feb. ‡Hodges, John, 45, *Townsend Road, St. John's Wood, N.W.*
1071 1895. Feb. ‡Hudson, Frederick Horace, *Holly Bush House, Holly Mount, Hampstead, N.W.*
1094 1895. Feb. ‡Hulse, James, 17, *Lime Street, Tyldesley.*
1073 1895. Feb. ‡Iles, Alfred R., 49, *Willow Walk, Bermondsey.*
1061 1895. Jan. ‡Jackson, J. W., *Government Offices, Douglas, Isle of Man.*
1087 1895. Feb. ‡Jones, Miss M. M., 5, *Grosvenor Place, Birkenhead.*
1066 1895. Feb. ‡Kusel, Edward Henry, 66, *Stopford Road, Upton Manor, E.*
1092 1895. Feb. ‡Laskey, C. W., 46, *Cromwell Road, Patricroft, Lancs.*
1047 1895. Jan. ‡Lawman John Compton, 23, *Wickham Road, St. Johns, S.E.*
1089 1895. Feb. ‡Lawrence, W., Jun., *Waltham Abbey.*
1048 1895. Jan. ‡Lockwood, W., 13, *Southgate Grove, N.*

1102 1895. Mar. ‡LOWE, Robert, 4, *South John Street, St. Helens, Lancs.*
1066 1895. Feb. ‡MACEY, Albert, *Gelligaer, near Maes-y-cwmmer, Cardiff.*
1104 1895. Mar. ‡McGRAW, H., 34, *Victoria Street, S.W.*
1081 1895. Feb. ‡MACLAREN, Miss Alice Kate, 3, *Barton Street, Westminster, S.W.*
1103 1895. Mar. MARSHALL, Robert Andrew, *Union Road Sanitary Works, Clapham, Surrey.*
1075 1895. Feb. ‡MAY, Thomas Frost, 24, *Gladwell Road, Hornsey, N.*
1097 1895. Feb. ‡MORGAN, R. Price, *Brynmcrug, Towyn, Merioneth, North Wales.*
1105 1895. Mar. ‡MYERS, Frank, 292, *Lancaster Road, Notting Hill, W.*
1049 1895. Jan. ‡OVER, George Complion, *Long Ditton, Surrey.*
1106 1895. Mar. ‡PAMPHILON, Edwin James, 18, *Stretford Street, Willmott Street, Hulme, Manchester.*
1085 1895. Feb. ‡PAVITT, Geo. O., 6, *Thomas Street, Ratcliff, E.*
1113 1895. Mar. ‡PHILLIPS, Henry S., *Church Street, Ennis, Co. Clare.*
1107 1895. Mar. ‡PHILLIPS, William White, *Bryn Eirw, Hafod, Pontypridd, Glam.*
1108 1895. Mar. ‡POWELL, William George, 7, *Essex Villas, Melbourne Road, Wallington, Surrey.*
1080 1895. Feb. ‡SHADICK, Alfred Wm., 13, *Brooke Road, Grays.*
1109 1895. Mar. ‡SHERVILL, John Alfred, 1, *Arthur Villas, Queen's Road, Teddington.*
1079 1895. Feb. ‡SMITH, John Buckingham, 7, *St. John's Road, Upper Holloway, N.*
1050 1895. Jan. ‡SMITH, William, *Claybury Asylum, Essex.*
1095 1895. Feb. ‡SPEDDY, Wm., 5, *Bath Terrace, Penrith.*
1051 1895. Jan. ‡STANTON, Sergt.-Major R. H., R.E., *Wemyss Villa, Calsayseat Road, Aberdeen, N.B.*
1110 1895. Mar. ‡STOCKMAN, F. C., 3, *Station Road, Finchley.*
1086 1895. Feb. ‡SUGDEN, H. C., 13, *Robertshaw Street, Bingley, Yorks.*
1074 1895. Feb. ‡THACKER, Miss J. M., *Lea Hurst, Monken Hadley, New Barnet.*
1070 1895. Feb. ‡TIMBERLAKE, Miss Mary E., *Sutton, Surrey.*
1057 1895. Jan. ‡TUDDENHAM, A. R., *Burgh Road, Aylsham.*
052 1895. Jan. ‡WALDRAM, Percy John, 13, *Buckingham Street, Charing Cross, S.W.*
1090 1895. Feb. ‡WALKER, David, 213, *Fountains Road, Liverpool.*
1111 1895. Mar. ‡WATERS, Thomas, *West Bromwich, Staffs.*
1062 1895. Jan. ‡WILKINSON, Thomas, 31, *Fitzroy Square, W.*
1053 1895. Jan. ‡WILLIAMSON, William Parker, 83, *Bayston Road, N.*
1112 1895. Mar. ‡WILSON, John, 64, *Victor Road, Manningham, Bradford, Yorks.*
1063 1895. Jan. ‡YORKE, John, 4, *Shrubbery Villas, Great Bridge, Tipton, Staffs.*

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OBITUARY.

Mr. ERNEST TURNER.

Ernest Turner, Fellow of the Royal Institute of British Architects, who died at Tunbridge Wells on the 16th of March, 1895, was the third son of the late William Hall Turner, F.R.C.S., L.S.A., Surgeon to the Asylum for the Deaf and Dumb, Southwark, and afterwards of Red Hill, Surrey. Mr. Ernest Turner, born on July 24th, 1844, was educated at King's College School, London, and afterwards articled to his cousin, the late Mr. Arthur Newman, Architect, also of Southwark. On the expiration of his Articles, he was for some years assistant to Mr. Bulmer, Architect and County Surveyor, Maidstone.

On the death of Mr. Bulmer he took an office and commenced practice; first in Verulam Buildings, Gray's Inn, then in Bedford Row, W.C., and lastly in Regent Street. Mr. Turner early turned his attention to practical sanitation, and soon stood foremost among architects in his knowledge of the principles of hygienic construction, and their application. One of his early successes was the acceptance, from a crowd of competitors, of his design for the Rotherhithe Sick Asylum. Afterwards he designed the Central London Throat Hospital, and the Hospital at Teheran, Persia. Besides these large undertakings he designed several steam laundries, such as those at Battersea, Kilburn and Penge, redrained a number of country houses, and also built several schools and private houses.

Mr. Turner's connection with The Sanitary Institute dates from almost its commencement. He attended the first annual meeting in 1876, before the incorporation of the Institute, and has always since that time been a member of its Council. He has filled various honorary posts as Chairman of Committees and a year ago was elected unanimously Chairman of Council. In the ordinary course of things, had he lived, he would have been elected for a second year. During his connection with the Institute no one has devoted himself with greater assiduity to its work; only urgent necessity ever caused his absence from a single meeting. Latterly the duties of Chairman of Council have been particularly arduous, and it is to be feared that his strict and conscientious labours were during the past few months in excess of his strength. He presided all through a Meeting of Council three days before his death.

Mr. Turner married in 1880 Miss Julia Davis, and the marriage was in every respect a most happy one.

Mr. Turner's extreme amiability of character endeared him to a large circle of friends; the more intimate the knowledge of the man, the more there was found to admire. Learned in all matters relating to his own profession, and gifted with great common sense, his opinion was always valued.

To the cause of public health, as embodied in the labours of The Sanitary Institute, the loss is irreparable, and the small society of men on whose shoulders the labour of the work chiefly rests, acutely feel the death of their able and industrious coadjutor. A. Wynter Blyth.

Note.—At a Special Meeting of Council held on March 20th, the following Resolution was unanimously passed and forwarded to Mrs. Turner:—"That the Council of The Sanitary Institute have received with profound sorrow intelligence of the death of their Chairman, Mr. Ernest Turner, F.R.I.B.A., who was one of the members of the original Council of The Sanitary Institute of Great Britain in 1877, and retained his seat on the Council of The Sanitary Institute up to the time of his death. The Council desire to record their appreciation of his unremitting devotion to the cause of public health, and to the Institute with which he was so long and so prominently connected. The Council would wish to convey to Mrs. Turner and the members of the family their sincere sympathy in the great loss they have sustained."

Mr. THOMAS TWINING.

By the death of Mr. Thomas Twining, of Perryn House, Twickenham, at the ripe age of 89, The Sanitary Institute loses one of its Vice-Presidents and firmest friends. When in 1876 the admirers of the late Dr. E. A. Parkes resolved to do honour to his memory, by establishing a Museum of Hygiene, Mr. Twining was one of the first to come forward and help the new enterprise with money, material, and most valuable suggestions. The food collection which now occupies the entrance corridor of the Parkes Museum in Margaret Street was the gift of Mr. Twining, and, though by no means above criticism, the careful perusal of the contents of the show cases, cannot fail to impress the observer with admiration for the thoughtfulness, method, and ingenuity of the planner and arranger of it. The generous support afforded by Mr. Twining to the Parkes Museum in its early days of struggling existence was largely due to the fact, that Mr. Twining not only warmly approved of the aims and

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objects of the Museum, but he found in the new institution a means of carrying on the idea of popular ocular instruction, which he had brought to great perfection in the Economic Museum at Twickenham, which he entirely established and supported. The destruction by fire of the Twickenham Museum (which was a model of skilful arrangement and wise method) in April, 1871, was a great blow to its founder, who had lavished upon it both money and thought. The Parkes Museum embodied many of the views of Mr. Twining, and the "*Synopsis of the Contents*" of the proposed Museum of Hygiene, which he drew up, printed and circulated at his own expense, not only helped to make the Museum widely known, but has served as a useful guide for those upon whom the subsequent management of the Museum has fallen.

Mr. Twining was one of the kindest of men. He was a great invalid, could not move without crutches, and had most delicate and sensitive eyesight. Those who conversed with him, as the writer of this brief notice has often done, were not long in finding that his feebleness was purely physical, and that he was able to defend and maintain his own ideas by an amount of knowledge and logical argument which was not to be easily overcome. His feeble voice and many bodily infirmities were not accompanied by any infirmity of purpose or vacillation of ideas.

Mr. Twining was in the forefront of those who have laboured for the practical education of the labourer and the artizan; and those who have seen "Polytechnics" springing into existence on all sides, must not forget that Thomas Twining, the author of "Technical Training," was one of the first to recognise the importance of this modern educational movement.

Mr. Twining's circumstances made it possible for him to devote his best energies to the working out of his own philanthropic ideas, and his physical disabilities, which developed early in life, compelled him to pursuits which involved mental rather than bodily activity. His schemes were all remarkable for a completeness of detail and a thoroughness which were alike exceptional. Mr. Twining's education was largely obtained on the Continent, in France, Germany, and Italy. He was a most accomplished linguist, and a quiet observer of all that went on around him. He acquired a good knowledge of the sciences at a time when such knowledge was rare, and he tried to throw the light of science upon the daily walk and common round, and laboured to show its important bearing on many of the most trivial details of domestic life. G. V. POORE.

CONTRIBUTIONS AND ADDITIONS TO LIBRARY

FROM JANUARY TO MARCH, 1895.

*** *For publications of Societies and Institutions, &c., see under "Academies."*

ACADEMIES (AMERICAN).

Concord, N.H. *American Public Health Association.* Reports and Papers. Vol. XIX., 1893. 357 pp., 8vo. Concord, 1894. *The Association.*

ACADEMIES (BRITISH).

London. *Institution of Civil Engineers.* Minutes of Proceedings. Vols. LI. to CXIX., 1877—1894. 8vo. *The Institution.*

London. *The Middlesex Hospital.* Reports of the Medical and Surgical Registrars and Pathologist for the year 1893. 450 pp., 8vo. London, 1894. *The Hospital.*

Aikman, *C. M.* Air, Water, and Disinfectants. 128 pp., 16mo. London, 1895. *Purchased.*

Angell, *John A., and* **Morley,** *J. G.* Practical Guide to Sanitary Legislation, containing a synopsis of the Acts relating to Public Health and Local Government. 638 pp., 8vo. London, 1895. *The Authors.*

Army Medical Department. Report for the year 1893. Vol. XXXV. 397 pp., 8vo. London, 1895. *The Director General.*

Boobbyer, *Dr. Philip.* Report to the Health Committee of the Borough of Nottingham on some points in connection with Conservancy and Water Carriage Systems for the Removal of Excreta in 78 Towns of Great Britain and Ireland. 14 pp., 8vo. Nottingham, 1894. *The Author.*

Bucks Sanitary Conference. Report of the Proceedings, with an Introduction by Miss Florence Nightingale. 48 pp., 4to. Aylesbury. *F. Verney.*

Corradi, *Prof. Alfonso.* Commiato Dallo Studioso Lettore. 28 pp., f.cap. *Prof. Augusto Corradi.*

Dicksee, *Bernard.* The London Building Act, 1894. 226 pp., 8vo. London, 1894. *E. Stanford.*

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Dutton, *Dr. Thomas.* The Rearing and Feeding of Children. 198 pp., 8vo. London, 1895. *The Author.*

Fairley, *W. Richmond Main Sewerage Board.* Engineer's Report, 1894. 27 pp., 8vo. Richmond, 1895. *The Author.*

Frankland, *Percy, and* **Frankland,** *Mrs. Percy.* Micro-organisms in Water; their significance, identification and removal, together with an account of the bacteriological methods employed in their investigation, specially designed for the use of those connected with the sanitary aspects of water supply. 532 pp., 8vo. London, 1894. *Purchased.*

Glen, *A.* The Law of Public Health and Local Government. 2 Vols., 1864 pp. 8vo. London, 1895. *Knight & Co.*

Grant, *Surg.-Capt. A. E.* The Indian Manual of Hygiene, Vol. 1. 441 pp., 8vo. Madras, 1894. *The Author.*

Kaye-Parry, *W.* The Sewage Disposal of Isolated Dwellings. 26 pp. (plates), 8vo. Reprint from the Proceedings of the Institution of Civil Engineers, Ireland, April, 1892. *The Author.*

Local Government Board. Dr. H. Timbrell Bulstrode's Report on the General Sanitary Conditions of the Village of Linslade in the Leighton Buzzard Rural Sanitary District, and on the circumstances attending an Outbreak of Diphtheria there. 5 pp., f. cap. London, 1894.

——— Dr. R. Bruce Low's Report on the Recent Prevalence of Diphtheria in the Hastings Registration District, and on an Outbreak of Small-pox therein. 33 pp., f. cap. London, 1894.

——— Mr. Evan Evan's Report upon the General Sanitary Condition of the Festiniog Urban District. 13 pp., f.cap. London, 1894.

——— Report on the General Sanitary Condition of the Hamlet of Crofton, in the Parish of Orpington, in the Bromley Rural Sanitary District, with special reference to the occurrence there of Localised Outbreaks of Diphtheria. 24 pp., f. cap. London, 1894.

——— Dr. R. Bruce Low's Report on recent Diphtheria in the Broadstairs and St. Peter's Urban Sanitary District. 6 pp., f.cap. London, 1894. *Dr. Thorne Thorne.*

——— Dr. S. Wheaton's Report on Prevalence of Fever in Mold Urban Sanitary District. 4 pp., f.cap. London, 1895. *Dr. Thorne Thorne.*

——— Mr. T. W. Thompson's Report upon the Water Supply of the Parish of Lympsham within the Axbridge Rural District. 4 pp., f.cap. London, 1895. *Dr. Thorne Thorne.*

——— Dr. W. W. E. Fletcher's Report on the Sanitary Circumstances of the Desborough Urban District, and on Prevalence of Enteric Fever. 4 pp., f.cap. London, 1895. *Dr. Thorne Thorne.*

Maxwell, *W. H.* Drainage Work and Sanitary Fittings. 74 pp., 16mo. London, 1895. *The Publishers.*

London. Seventh International Congress of Hygiene and Demography. Transactions (13 Vols.). *The Executive Committee.*

Massachusetts, *State Board of Health.* Examinations of the water supplies and inland waters of Massachusetts, 1887—90. Part I., Report on Water Supply and Sewerage. 857 pp., 8vo. Boston, 1890. *Purchased.*

——— Experimental investigations upon the purification of sewage by filtration and by chemical precipitation, and upon the intermittent filtration of water made at Lawrence, Mass., 1888—89. Part II. 910 pp., 8vo. Boston, 1890. *Purchased.*

MEDICAL OFFICERS OF HEALTH AND OTHER SANITARY REPORTS.

Foleshill. 1894. *S. A. Pitchforth.*

Leeds, 1893 .. .. *Dr. J. Spottiswoode Cameron.*

River Tyne Port Sanitary Authority. 1894. *Dr. H. E. Armstrong.*

Torquay. 1894. *P. Q. Karkeek.*

West Bromwich. 1894. *Dr. Herbert Manley.*

Whitechapel. 1894. *Dr. J. Loane.*

Wigan. *Sanitary Inspectors'*, 1894 .. *J. Sumner.*

Massachusetts. Manuals for the Use of Boards of Health of, containing the Statutes relating to Public Health, &c. 214 pp., 8vo. Boston, 1894. *The Board.*

New York State Board of Health. Fourteenth Annual Report, 1894 (3 volumes). Vol. I., 869 pp., 8vo. Albany, 1894. Vol. II., 510 pp., 8vo. Albany, 1894. 8vo. volume of Maps accompanying Report. *The Board.*

Notter, *Prof. J. Lane,* and **Firth,** *Surg.-Capt. R. H.* Hygiene. 374 pp., 8vo. London, 1894. *Prof. J. Lane Notter.*

Nottingham, The Meteorology of, for 1894. (tables), f.cap. Nottingham, 1895. *Dr. P. Boobbyer.*

Paris. Direction Administrative des Travaux de. Notes a l'Appui du compte des dépenses de l'Exercice, 1893. 494 pp., 4to. Paris, 1894. *Le Secrétaire.*

[redacted]

Registrar-General (**England**). Fifty-sixth Annual Report of Births, Deaths, and Marriages in England during the Year 1893. 230 pp., 8vo. London, 1894. *The Registrar-General.*

Registrar-General (**Ireland**). Supplement to the 27th Report of Births, Deaths, and Marriages in, containing decennial summaries of the returns of marriages, births, deaths, and causes of death in Ireland, for the years 1881—90. 104 pp., f.cap. London, 1894. *The Registrar-General.*

Registrar-General (**Scotland**). Supplement to the Thirty-Eighth Annual Report. 157 pp., 8vo. Edinburgh, 1895. *The Registrar-General.*

Roche, *Prof. Antony.* Inaugural Address delivered before the Medical and Scientific Society of the Catholic University Medical School (Dublin), November 10th, 1894. 3 pp., 8vo. *The Author.*

Rohé, *Dr. G. H.* Text-book of Hygiene: a Comprehensive Treatise on the Principles and Practice of Preventive Medicine from an American standpoint. 3rd Edition. 553 pp., 8vo. Philadelphia and London, 1894. *The Author.*

Rome. La Piridina nei prodotti della Torrefazione dell caffé del Prof. A. Monari e di L. Scoccianti. 3 pp., f.cap. Rome. *Ministero dell Interno.*

——— Relazione Intorno alla coltivazione delle risaie nell' agro parmense del Prof. Dott. Luigi Pagliani e Ing. C. Guerci. 34 pp., f.cap. Rome, 1895. *Ministero dell Interno.*

——— Circa i Fatti principali riquardanti L'Igiene e la Sanità pubblica nel regno nel secondo semestre dell' anno 1894. Epidemia Colerica all' Estero e misure preventive nello stato. Relazione del Direttore Prof. L. Pagliani. 34 pp., f.cap. Rome, 1895. *Ministero dell Interno.*

Stacpole, *Capt. J.* A Guide to Meat Inspection for Regimental Officers. 52 pp., 8vo. London, 1894. *Purchased.*

Switzerland. Vierter Jahrgang, 1894: Annuaire Statistique de la Suisse. 444 pp., 8vo. Berne, 1894. *Bureau Féderal de Statisque.*

Tomlins, *W. H.* The Droitwich Brine Baths as Therapeutic Agents in various Diseases. 22 pp., 8vo. London, 1895. *H. K. Lewis.*

Turner, *Ernest.* Report to the Social Economy Committee (Paris Exhibition, 1889) on Public Baths and Washhouses. 16 pp., 4to. London, 1889. *Purchased.*

Ventilation. A Danger to the Public Health. Part III. 14 pp., 16mo. Reprint from Local Government Journal, December 15th, 1894. *W. Whitaker.*

——— A Fatal System of. Extracts from a Paper read by Mr, Keith Young before the Architectural Association, London. November 23rd, 1894. 7 pp., 16mo. *W. Whitaker.*

Warsaw. Zdrowie miesiecznik poswiecony Hygjenie publicznej I prywatnej. For the year 1894. *J. Poloka.*

——— Kalendarz Lekarski na rok, 1895. 16mo. Warszawa, 1895. *J. Poloka.*

Weyl, *Dr. Theodor.* Die Gebrauchsgegenstände im Anschluss an die Gesetzgebung des Deutschen Reichs und an die der übrigen Kulturstaaten (mit 1 abbeldung). 71 pp., 8vo. Jena, 1894. *The Author.*

Wien. In den gewerblichen Betrieben vorkommende staubarten in Wort und Bild. 10 pp. (plates), 4to. Wien, 1892. *Dr. J. F. J. Sykes.*

THE FOLLOWING JOURNALS AND PERIODICALS HAVE BEEN RECEIVED DURING 1894.

Weekly.

British Architect.
British Medical Journal.
Builder.
Contract Journal.
County Council Times.
Food and Sanitation.
Illustrated Carpenter and Builder.
Indian Engineering.
Industries and Iron.
Journal d'Hygiène.
Journal of the Society of Arts.
Local Government Chronicle.
Local Government Journal.
Nursing Record.
Surveyor.
The Sanitary Engineer.
The Sanitary Record.
Veterinary Record.

Monthly.

Health Record, Dublin.
Ironmongery.
Medical Magazine.
Journal of the Royal Institute of British Architects.
Journal of Society of Architects.
Journal of Society of Chemical Industry.
Meteorological Record.
Plumber and Decorator.
Practitioner.
Public Health.
Sanitarian, New York.
Sanitation in the West.
Sei-i-Kwai Medical Journal.
Zdrowia.

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Journal of the Royal Meteorological Society.
Journal of the Royal Statistical Society.
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THE SANITARY ASPECTS OF THE LONDON BUILDING ACT, 1894.

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Read at Sessional Meeting, December 12th, 1894.

This is the second time within the last few months that I have had the honour of being called upon to address you, and on both occasions on very much the same subject. To-night, however, I do not propose to deal with the general question of the crowding together of houses, but rather with the actual position in which London is placed, or will be placed, by the alteration in its Building Laws after midnight of December 31st.

Everyone is agreed that the London Building Act, 1894, is a very extraordinary measure; some people think extremely so. It is extraordinary in many ways. In the first place it passed Parliament as a Private Bill, repealing in whole seven public Acts of Parliament and partially repealing seven others. It is a Private Bill consisting of 218 clauses and 4 schedules. It is such a large work that without mentioning names of specified individuals I may say that prominent and experienced government officials up to the last did not think the Council was serious in its attempt to pass that measure. We did so, however, and this shows that we were not so foolish as some people imagined. I do not intend to tell you to-night how this measure differs from the original measure that was introduced, nor to tell you that the Council or I myself are personally disappointed in the result, nor to argue in favour of this or that clause. As many of you present are practically concerned in carrying out this Act, the

best thing I can do is to take you clause by clause through those parts of it which have a bearing of special interest to members of The Sanitary Institute.

Of course there are many clauses which are directed to good construction and so have a sanitary bearing, but I allude rather to those with a more direct and immediate sanitary bearing. Whatever else may be said it is well to know that this volume contains the entire statute law of building for London as it will be after the beginning of the new year, whereas formerly it had to be searched for, through twenty Acts of Parliament. I am not prepared to say that it is free from ambiguity. I may even say that we have instructed eminent counsel in one case to tell us what the Act means. I may, however, say in justification of this condition that we are not asking for an interpretation of any clause as it stood when we introduced the Bill, but of the Act as it emerged after it had run the gauntlet of two Select Committees. I wish to say, moreover, in justice to the Opposition, that the Bill as originally introduced was very impracticable. It was not intended to be practical in its then form, but I am perfectly convinced that we adopted the right plan in introducing it as we did. Had we attempted to meet the opposition at that early stage we should have had a far less useful measure than at present, because it was not until we were brought face to face with our opponents that we could see where the shoe pinched. I am prepared to go even further, and say that although the utility of some portions of the Bill was marred by people attacking it in all directions, this measure in its present form is more practical than when it was introduced by the Council this time last year. I do not think London on the whole need regret the opposition that was made to the Bill. This, of course, is a general statement, because there are undoubtedly individual instances in which the difficulty of working has been increased. Unfortunately, there is not in this country any machinery for re-drafting a Bill after it has left both Houses of Parliament. There are things in this Bill which do not express the views of the opposition, and they would probably be prepared to accept my amendment thereof.

To begin at the beginning, the first thing is the definition clause. There is one definition which has only an indirect interest for you, but it is so important that I wish you clearly to understand it. It is as to the height of houses. The 21st definition as to the height of buildings deals with matters not generally understanded of the people. The height of a building does not mean the height of a building, *i.e.*, not the height from the pavement to the top of the gable or ridge of the roof, but the height from the pavement to the parapet, the eaves, or the

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base of the gable, so that a limitation to 60 feet in height means 60 feet to the eaves, top of the parapet, or base of the gable.

The 25th definition defines a dwelling house as a building constructed wholly or partly for human habitation. This is plain enough for ordinary common-sense people. A domestic building includes a dwelling house and other buildings. The parts of the Bill which deal with domestic buildings are mostly concerned with dwelling houses.

The 37th definition defines the expression "inhabited," as applied to a room to mean a room in which some person passes the night, or which during the day is used as a living room. That definition you will see differs from the old legislation in regard to underground rooms. If there be a fair presumption that it is used as a living or as a sleeping room it is to be held to be so unless the contrary be proved.

I now pass on to Section 13. Curiously enough it is a section which passed with very little trouble, yet it is to my mind worth the whole of the rest of the Bill. It is said that this Bill cost the promoters £10,000. Well I consider that this sum paid by the ratepayers of London as the price for Section 13 is one of the cheapest bargains they have ever made. This is the clause which has a marginal note in reference to new streets to the effect "that no person shall erect a building nearer than 20 feet from the centre of the street unless it be upon the site of an old building." There is very little difference except in matters of words between this and the present law. If you attempt to put up a building where no building previously stood abutting on a narrow street, a gentleman will come down upon you and you will have to pull the building down and set it back. But that only applies to ground upon which no building previously stood. Where the building previously stood you had a right before and you have a right now to erect a new building, provided it does not go nearer to the centre. So far there is no gain, but near the end of the clause come the words "provided always that no dwelling house to be inhabited, or adapted to be inhabited, by persons of the working class, shall, without the consent of the Council, be erected or re-erected within the prescribed distance, to a height exceeding the distance of the front or nearest external wall of such building from the opposite side of such street." Let us take for example a street with a width of 15 feet. There are old buildings on either side which are 30 feet high. If these are houses in some crowded part of London inhabited by many families, anyone can at present pull them down and can re-erect upon them so called model dwellings to as great a height as he likes short of 90 feet. He

would probably draw a line at 50 feet, because the upper parts of the building would be unlettable. If the County Council condemned these houses as unfit for human habitation they might be built 30 feet higher, all crowded with families of the poorer class. Whatever the internal improvements, with regard to the overcrowding, the last stage would be worse than the first. If, however, in future we were to condemn them as unhealthy, the owner might put up warehouses; but if he wanted to erect buildings which were suitable for habitation by the working classes, he would be limited to the width of the street, viz., 15 feet. If, therefore, we close the houses as unfit for human habitation, we know that the worst that can happen (if he build on his old foundations) will be that he will build buildings not exceeding 15 feet in height. He has another alternative: he may widen the street just so far as he thinks proper, and in this proportion he may increase the height of his buildings. You have then this important result: there are many areas in London, like the famous Bethnal Green area, where the streets run from 18 to 25 feet, and contain houses two or three storeys high, the general structural condition of which is very bad. The question is what to do with them. Under Cross's Act, all that could be done was to buy the whole thing out and reconstruct it, for this reason: if you condemned them the owner always had it in his power, when rebuilding, to raise them to a greater height, and while there is no objection to a height of 20 feet in a street of 20 feet wide, there is great and obvious disadvantage when you run the buildings up to 50 feet. When, therefore, it was argued that we ought to have gone to work with the Bethnal Green area in another manner, my reply is, that it was the only manner which was open to us. The cost was something over £300,000. This simple law might not apply to the whole of that area, but it would apply to a great deal of it. We shall now be able to force owners of the land to lay out their buildings in a reasonable and sensible manner. The importance of that clause is not I think sufficiently understood except by those members of Council who have worked at the subject for years past.

We will now proceed to the celebrated Part 5 of the Bill, the one about which most of the fighting before Parliament took place. This is called "open spaces about buildings and the height of buildings." The first section starts with the assurance that offices and counting houses are not domestic buildings. This concession was necessary because it allows buildings to be crowded together on the exceedingly valuable land in and near the City to a greater extent than would otherwise be possible. There are few people, and practically no children, who have to

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spend their time there, so that no sanitary evils are likely to accrue from this aggregation of buildings.

Clause 41 is the "angle clause." I have heard it spoken of by some blaspheming Philistines as the "Longstaff Clause," but I repudiate the charge. I go further, I prefer to put it in other language. I am not able to claim the honour of having originated the principle upon which it is based, but the gentleman to whom this honour belongs is here this evening. I am alluding to Mr. Goldstraw, Building Surveyor of the City of Liverpool. This is a very simple matter, but this is all the more to his credit. The genesis of this clause was thus wise. Liverpool, having suffered more than other places from overcrowding, some years ago adopted the model bye-laws of the Local Government Board in reference to space at the rear of houses. This is in effect that there must be a space free from any building extending from the back wall of the premises in proportion to the height of the building. He found in Liverpool that it was considered a great grievance that they were not allowed to build one-storey buildings for wash-houses, &c., on this vacant space. He did not consider that much harm would attach to such a practice, but said there was already a sliding scale of a certain kind, and he urged that it would be better to say that 10 feet must always be left free at the rear, and then draw an angle of 45° within which limit the builder could do what he liked. That is the one and only means of laying down the height of a building in a way that is equitable in all cases. That was the clause of the original Bill. Since that Bill became law I have gone over slums in Liverpool that were re-constructed under the original rule. I do not believe that there is an architect present if he were to go and see these buildings as they are who would not admit that these buildings are as close together as buildings ought to be placed. It may be sufficient, but it is not greater than is fair, right, and proper. Parliament, however, thought otherwise. The existing law is that every building should have a space exclusively belonging to that building free from any erection above the level of the ground, having an area of 100 square feet. The same rule applied to a big hotel as to a small cottage. It is better than nothing, but it proved wholly inadequate. The Metropolitan Board of Works in 1882 succeeded in getting Parliament to allow that the space should be a depth of 10 feet extending throughout the whole of the rear of the building. It only went up to 450 feet it is true, but this was a great advance on 100. That limit covered most buildings, but the, to my mind, serious objection is that the Act of 1882 allowed buildings all over the ground floor.

Well now as regards buildings erected hereafter, upon streets laid out hereafter, what Parliament has given us is this: a clear ground space of ten feet, free from all building, and extending throughout the whole frontage. They then give us the angle of 63½°, so that the distance from the rear boundary wall to any part of the building is equal to half the height of the building. Anything you put beyond the ten feet must be built within this angle. This has the same fundamental virtue of equity that applies to any angle, but it does not give as much space as I should have liked. Still the result works out not so very badly. It follows that the buildings abutting upon one street will be separated at the back from those abutting on the next street, by a distance equal to their height. That will be the state of affairs in the new London. When we come to the more central parts, and in all streets made prior to 1895, there is the ten foot distance, but like the Act of 1882, owners are allowed to cover the ground floor with buildings up to the height of sixteen feet. Then the same angle of 63° is struck from that point, and consequently if they build with a ten foot limit they can get their building twenty feet above the flat roof of the one storey addition. I admit that there are a number of streets which have been laid out so close together that it would be exceedingly hard upon landlords to enforce the first rule, and this second, modified rule, is better than the present law.

We go still further than this in the endeavour to meet vested interests: if a man has old buildings on his land he may replace them, however bad they may be, but he may be prevented from making them worse than before, hence the new bill will not improve old sites. People earning 25s. or 30s. a week may have some relief even from this clause. We have these words which occur in the 41st section "except in the case of dwelling houses inhabited or intended to be inhabited by the working class." This is class legislation it is true, but if you are in the unhappy position of being the promoter of a bill, the goal that you aim at is to get these mystic words "royal assent" printed on the first page, and you must make concessions with that object in view. Beyond motives of expediency there are other motives which are logically or legally correct. We say, the offender in this question of class legislation was the Parliament which passed the Housing of the Working Classes Acts, placing these buildings in a different category from those of the people who, like you and me, only work without belonging to the working classes; Parliament having made that distinction by throwing here in London, upon the County Council, and elsewhere, upon the appropriate authority, the imperative duty under certain circumstances, and at whatever cost, to buy out unhealthy

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dwellings of the working classes, and to see that more suitable buildings are erected thereon. And the Council held that Parliament having insisted upon that, it was only fair that Parliament should give us the power to say to owners "you shall not make any more of these slums which we are compelled to buy up afterwards and pull down." I think that is an unanswerable argument to the objection. It is evident that the worst class of dwellings will usually only be erected for these people who can pay but small rents. Next, after the downright slums, comes the modern "mansions." We have succeeded in dealing with these in a different manner, and in a manner which I think will prove effectual.

Section 42 deals with the erection of working-class dwellings not abutting upon any street at all, *i.e.*, built upon back land. When you cannot conveniently get at land at the back of main streets, it has become the practice to construct large blocks of dwellings. We have now got a clause which compels persons who are going to erect such buildings to submit their plans to the County Council. There is a limit set to this. I take the credit of having put that limit. We are not allowed to raise the standard above a certain point. Clause 44 interests the owners of large estates. Mr. Cubitt Nichols pointed out to us that where it is desirable to reconstruct an area altogether, to put three streets where there were formerly five, and so on; that in these improvement schemes the landlord invariably considerably improved the conditions compared with what they were before. But such streets might be held to be new streets, and the ground might be of such great value that it would not be fair to oblige the owner to deal with the land as though he were dealing with virgin land at Tooting or Streatham. This clause allows the County Council, subject to his submitting his plans, to make such modifications as they may think proper from the restrictions which might be legally enforced, and I think that that is a very fair concession. The great landlord often gives us for nothing a scheme fifty per cent. better than we had before, and we should be grateful to him.

Now as to Clause 45. This is a very remarkable Clause. I had no reason to accuse the distinguished Counsel who harried me in Committee with being asleep, but they were certainly asleep when this particular Clause was passed. It gives no discretion to the County Council, and it allows no appeal! I said just now that next to the slums the blocks of modern mansions were the worst. They are the worst because they have so little space about them. Take a given area. The builder covers nearly the whole of his land, and endeavours to get light and air by ridiculously small shafts or internal courts.

I have always maintained that this is a thing that ought not to be allowed. I see here to-night a medical officer of health who, I believe, dwells in a house of this kind, which he considers is a model of insanitation.

Now we have provided for a certain proportion between these holes and the size of the building. We insist upon the admission of air from the bottom. Further, we say no habitable room shall be constructed looking into such a court, unless such court shall be equal in width to one-half its height (or depth). We give them in the ground floor, but we say you shall not run the building up higher than twice the width of the court, measured from the window-sills of the first floor. Of course, if you use these courts merely for ventilating water-closets, larders, and the like, as these are not habitable rooms within the meaning of the Act, this clause would not operate; we say it is not right to put even domestic servants in such rooms. We have even gone a step further: There is a pattern of dwelling in London which may be described as the "comb" pattern. It consists of a pectinated building, in which a long frontage has sprouting out from the rear a number of back buildings joining with the main building at a right angle. You will see that by this arrangement the lower rooms where the angles join can have little chance of light and air. Yet remember, this is a plan constantly adopted in the construction of artizans' dwellings. Where it is a large house and the people can move about from room to room, it does not matter so much, but where they are fixed to these one or two rooms, the conditions are obviously very unfavourable to health. Here we have a similar rule to the other. The builder is not allowed to construct these courts of such a proportion that their width would be less than one-half their depth. This means that you will get perhaps one block less in such a building, but it ensures a semblance of sufficiency of light and air throughout.

I shall not go into questions of corner plots and things of that kind, but I will mention one matter more in reference to the height of buildings. The new Act does not deal with the question of height in the beautiful symmetrical way that the original Bill did, but we have touched it in three points: (1) The limiting angle at the rear; (2) When the County Council asked for a limit of 70 feet for the height of the eaves in 1890, they were opposed by a certain important institution, and the height was altered to 90 feet. Subsequently the said institution met us and agreed to a 75 foot limit. The new law differs from the old in this small respect: That whereas a building commenced before the 31st of this month can be erected to a height of 90 feet, if commenced after that date it will be

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limited to 80 feet. (3) There is, however, another limitation in another part of the Act. Some architects grumble, but I do not think they have much to grumble at. There was, once upon a time, a man who wanted to build a mews. Mews we always consider to be inherently unhealthy, and we have always insisted that a mews must be as wide as a street. This man was only going to make his 20 feet wide. We said he might do so if his buildings did not exceed 20 feet in height. So far so good; but he proceeded to construct what he called a roof containing two more storeys. It was merely a slightly slanting wall. We have got him now under Section 71, which says that no part of a roof except a spire shall exceed an angle of 75 degrees. We throw the roof in, in measuring height, but if so it must be a genuine roof.

Section 69 insists on the ventilation of staircases in large buildings, and Section 70 for the first time in London legislation (borrowed from the model bye-laws of the Local Government Board) insists on all inhabited rooms having windows of sizes proportionate to the rooms.

Section 70, sub-section E, provides that rooms over stables shall have such construction of floor that emanations from the stables below cannot get into the rooms above.

Section 97 very indirectly touches upon health matters, but it does so in some parts of London. That is the clause limiting the method in which you may stack timber and firewood. We say that if a man stacks timber on the fore-court of his premises he must dress back to the general line of buildings.

I have now come to the end of my programme, and I shall be glad to explain any matter which I may have left in doubt. Those of you who are practically concerned with public health will I think see that at all events whatever else may be said of the London Building Act it is a very important measure. Personally, and this is an opinion founded on experience gained years ago, I think this is a more important sanitary measure than any passed hitherto for London. Most public health legislation deals with things which are more or less temporary in their nature, but the bad laying out of a town, the construction of the streets which are too narrow, of buildings which are too lofty or too close together, are ills which are practically irremediable. Therefore a measure designed to prevent the occurrence in a city of such evils, is a measure of the very first importance. Anyone who has seen the slums of Liverpool will see what a gigantic evil arose from that city expanding at an unparalelled rate at a time when there was no sanitary supervision, and he will know the evil inheritance that has fallen upon Liverpool. He will see on the other hand

the great activity of the Municipality of Liverpool in striving to remedy these evils. But at what a cost to the ratepayers, all for the want of sanitary legislation! Liverpool, however, has now a better building code than even London will have in 1895.

Mr. W. Goldstraw (Building Surveyor, Liverpool) said: London is to be warmly congratulated upon obtaining such a very beneficial measure as the new Building Act, and the County Council is to be equally congratulated on having such a Chairman of the Building Act Committee. As we have long been in the habit of speaking of Cross's Acts and of Torrens's Acts, &c., it seems only right and natural that in years to come we should allude to this as the Longstaff Act. He should like to express a confident opinion that the Bill as originally introduced was better than the Act as now finally passed; not better in point of form, because he was sorry to say it was never good in this respect, but in regard to the matter of it. For an illustration he said he would not travel further than the Section which deals with the question of angle. He thought it was better with the proposal for a limiting angle of 45° than with a compromise of 63½°, speaking more particularly of the regulation as it would have applied to dwelling houses. He thought that as it does actually apply under the Act to all domestic buildings, perhaps this was fair compromise; but he could not help thinking that if the angle of 45° had been retained as applicable to dwelling houses, and the other angle had been applied to domestic buildings, or some of them, the regulation would have been better than it is. Being a compromise it has this drawback, that the regulation as it now stands applies to some cases in which it need not in fairness have applied. The definition clauses are highly important as bearing on this question. Take a workshop 100 by 50 by 30 feet. Such a workshop must have an open space throughout the rear. This may sometimes seem a hardship; and he would have felt inclined to say that, in such a case, asking for an open space along the back of the workshop was needlessly severe; yet it is a necessary outcome of the section as it stands.

Dr. Longstaff: It would probably come under the workshop class, and so be exempt.

Mr. Goldstraw: Then, with regard to the question of the 45° angle. When he was last in London, walking on the Embankment he noticed at the end of a street running down from the Strand a block of buildings cut off behind at the angle of 45°, apparently for the purpose of avoiding a question of light and air to the buildings at the rear. They did not appear to be at all damaged by the restriction; the offices were very light, and they were exceedingly ingeniously constructed. It seemed to him that if this kind of architecture were

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generally adopted, it would not lead to an ugly style. If it was not an overwhelming hardship to have to cut off the building at an angle to avoid litigation with the neighbours, it would not be a very great hardship if it were curtailed to the same extent to comply with the London Building Act.

Mr. H. P. Boulnois (City Engineer of Liverpool) thought that it was a pity that this otherwise admirable Act is not more of a consolidation Act. It is a fact, as Dr. Longstaff has said, that the provinces have undoubtedly been ahead of the Metropolis in all sanitary measures; but nearly all the London Building Acts were originally passed under the influence of the panic caused by the great fire of London, and therefore they contain a great many constructive clauses which hamper builders and holders of property, but do not touch upon the great sanitary questions which have since so much occupied the attention of the country. A point on which he was opposed to Dr. Longstaff was the question of carrying the party wall through the roof. He looked upon that as an unnecessary and harassing measure, and if these and other similar provisions were taken out and more sanitary provisions put into it, he thought the Act would have been greatly improved. This Bill was heartily supported by Medical Officers of Health and other sanitary medical men, but did not receive the support that it should have received from the architects as a profession in the Metropolis. He supposed they felt that the interests of their clients as owners of property required to be protected. With regard to the proposed area to be left in front, the Bill, as he understood it, does not in any way confiscate the property of owners. With regard to the area at the back, he agreed that it was a pity that the 45° was not accepted as to dwellings, and after that modifications might have been made in respect of every other building. In this way the supposed hardship of the angle of 45° would not have been felt. On the question of area at the rear of dwelling houses, he had had sufficient experience with regard to this space to say that it is inexpedient to have too much area at the ground-level. It is often misused and becomes a receptacle for rubbish of every description; but this idea of an angle of 45° gives, as it were, a plane of space on every storey, and this space increases as you go up. He would like some explanation in reference to this peculiar angle of $63\frac{1}{2}$°. Perhaps Dr. Longstaff would enlighten him on the sanitary reasons that led to this angle being chosen.

Dr. Longstaff: The angle of $63\frac{1}{2}$° is the angle whose tangent corresponds to 2. It is beyond question the angle of all angles which the unskilled mechanic can apply with a foot rule.

Mr. Boulnois (continuing): Section 49, with regard to the height of chapels and churches, might advantageously have included gasometers; they are sometimes carried up to a great height excluding

light and air, and he did not find anything in the Act to prevent that. He heartily congratulated Dr. Longstaff upon the success of his labours in carrying through this Bill.

Dr. L. Parkes (London): As to the utility of such an Act anyone who walks about London must be perfectly convinced. New buildings, in many instances were being raised to double the height of the old buildings; and many of the principal streets for some years past, had been steadily deteriorating as regards light and air. The L. C. C. had done a great work in carrying through so large a measure as this Act. Dr. Parkes endorsed everything that was said with regard to lofty blocks of mansions, so many of which had been built of recent years. In some instances, inner rooms were lighted from narrow shafts measuring not more than seven or eight feet across, and perhaps eighty feet in height; and it was not uncommon for servants to have to live in rooms lighted and ventilated entirely from these shafts. Inasmuch as servants were indoors most of the day, the want of light and air in the sleeping chamber was likely to be especially prejudicial. If these shafts were only used for ventilating closets and larders there would not be so much to which exception could be taken, though he did not admit that it was desirable to have larders ventilated from the same shaft which gave air to the W.C.s. It was truly ridiculous that in the past, buildings should have been allowed to have been erected, some of the rooms of which medical officers of health have declared to be unfit for human habitation. In some districts, such buildings have been run up despite the protests of the M. O. H., who was, however, unable to intervene until they were finished and ready for occupation.

Mr. Edwin T. Hall (London) protested against the assertion that architects did not support the Act. That was not a fact. The Royal Institute of British Architects did their best to make the Act the best possible. What they did was more than that. They were he thought the original cause of this Bill being brought forward at all. The late Government in 1887 produced a Bill for the consolidation of all the Building Acts in London, and wrote to the Institute of Architects for suggestions. The Institute replied advising that the Acts should be at the same time amended, and they appointed a Committee not only to consider the consolidation but to draft a satisfactory amended Bill. It is to the credit of the County Council and Dr. Longstaff that they took up the subject and brought it to a successful issue. The Institute gave them every assistance, furnished them with their own draft, and were in constant correspondence with them, their sole object being to get the best Bill from a practical point of view. It is a fact that the Institute of Architects was obliged to oppose certain portions of the Bill, but this was only to make it more perfect. We must not forget that the Bill as drafted was very confiscatory in many of its clauses. It insisted that every house after destruction or pulling down should be set

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back 20 feet from the centre, but there are over 30 miles of streets in the city of London less than 30 feet wide, and it would have involved twenty millions of pounds loss to the owners, not of the land only, but the ratepaying owners of the houses, to carry this provision into operation. That has been removed from the Act, and he maintained that under these circumstances the Institute of Architects were justified in opposing the clause. They were anxious to get an Act for the benefit of the whole community with due regard to private interests. It is regretable that the Act does not contain any provision dealing with the drainage within the curtilage of the building. It is true that power is given under another Act, but the jurisdiction is different. As to the difficulty of interpretation, it is of course very difficult when a clause has been cut about and altered line by line and word by word in a committee room of the House to make it comprehensible. That is not the fault of those in charge of the Bill. There is one other point as to interpretation, and that is that the definition of inhabited room in this Act differs from that of the Public Health Act passed only three years ago, and this he thought was regretable. It was proposed to have a separate definition for rooms in which people pass the day but not the night, and that would have been an improvement, if it had been possible. The great feature claimed for the Act is the angle in Section 41. One gentleman has said that it would have been much better to have an angle of 45°, but as originally proposed this would have applied to every building in London, not only houses, but warehouses, shops, and offices, and the effect would have been to sacrifice an amount of property which could hardly be estimated in figures. With regard to houses in the suburbs it might be reasonable enough, but the Institute had to deal with the Bill as they found it, and so opposed it. There ought, we are told, to have been an area at the back free down to the ground. He put it to them as men conversant with London, if in the case of a shop with no living rooms beneath, where a ground floor is not carried over the back area this does not become a refuge for rubbish? It is much better that the small area should be made into a show room than a dust-hole. Under existing Acts it was said that 450 square feet was the maximum at the back of a building, and that as a fact gave you 10 feet between the building and the rear fence. That is not so, for there was nothing to prevent your making part of your building right up to the fence. The Institute of Architects suggested that the 10 feet should be carried the whole width of the building and not to the ground floor only but also to the basement if there were any dwelling rooms there. As to the rear outline, he thought the enacted angle of 63½° is a fair and reasonable compromise, having regard to the immense value of land in London. With regard to exceptions in favour of the working classes the legislature has laid down the principle that dwellings intended for their use should be treated on different grounds from those erected for persons who are more free agents. Labourers have to live in whatever is provided for them close to their work, while ordinary individuals can

go and live in the suburbs if they think fit, and therefore do not need any protection. Dr. Parkes wss undoubtedly right in his remarks as to the mean little shafts in the modern mansions, but there is another shaft which is not mentioned. With regard to the question of the height of buildings, Dr. Longstaff was in error in ascribing the 90 feet of the County Council General Powers Act of 1890 to the action of the Institute of Architects. He had the honour of representing the Institute of Architects in Parliament on that Bill, and what happened was this: we had proposed 75 or 80 feet, but the other opponents got 90 feet, because it was found that the handsome mansions erected in recent years on the Grosvenor Estate were in parts nearly 85 feet high, and it was for this reason that the Committee consented to 90 feet. Dr. Longstaff does not refer to the damp-proofing of the underground rooms, but in 1891 a very important sanitary improvement was obtained by providing that not only were the floors of basement rooms to be protected from the uprising of damp and ground air, but also that the walls of such rooms should be similarly made damp-proof. That was obtained on the representation of the Institute of Architects. In conclusion, he desired to bear my testimony to the important services rendered by Dr. Longstaff to the public, in carrying through this most important and beneficial Act, a task most arduous and deserving of our warmest recognition.

Prof. BANISTER FLETCHER (London) said he should like to know what is the meaning of Clause 45, as to the adequate provision for the ventilation of courts by means of a "communication" at the lower end of it. What is the communication to be? He supposed some would use a tube, but possibly Dr. Longstaff would tell us what the Council had in view in putting these words in; because they certainly are not clear as to what is the kind of communication required. Another point he would call attention to was the taking of the angle from the sill of the window to regulate the height of court. That does not seem wise. In fact it is a great pity, because the line being taken from the sill, the builder will be tempted to get his light in width, in order to raise the sill, and thus the lower part of the room will be dark. As to the diagonal line, he thought that this would lead to a great amount of bad building. You can go up a number of storeys, and everyone of your back rooms will be set back upon girder after girder or sloped back with all the objections of dormer windows on every floor. With regard to Section 13, sub-section 15, upon which Dr. Longstaff has laid so much stress, he would like to point out what it appears to him the injustice—supposing houses require re-building as Dr. Longstaff has pointed out, and assume that on one side of the street are houses occupied by the working classes the owner of such houses will be forced to re-build limited in height to the width of the street, whilst the owner on the other side, if his houses are *not* occupied by the working classes, can go to a very much greater height and gain an unfair advantage. If the operation of the Act could be

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so limited so as to give equal justice to all, he thought it would add to the great merit of this great labour.

Mr. W. W. Bruce (London County Council) said that many of the sanitary clauses of this 1894 Act may be taken to be the necessary corollary and sequel of the previous health legislation, which has been referred to several times this evening. If we had tried to incorporate in this Bill any portion of the Public Health (London) Act, 1891, as has been suggested, it is highly probable that you would not have seen this Bill on the statute book. The supervision of the carrying out of the Housing of the Working Classes Act, and also of the Public Health (London) Act, 1891, and in some cases the actual carrying out of the Acts rests with the committee of the County Council, of which he was vice-chairman, and it was in the day-to-day working of this committee during the last few years that the necessity of these sanitary clauses in the new Act was demonstrated. Very much of the value of these two Acts was entirely negatived by the old and very bad Building Acts. One or two illustrations will show how they hampered the Committee. Dr. Longstaff has referred to that large unhealthy area of Bethnal Green which the County Council has been clearing, and which contained fifteen acres of narrow slums. There were 5,700 people upon this area and 69 different sets of freeholders. The claims amounted to £457,000 and were settled for £266,000, the actual loss to the rate-payers of London being £280,000 for clearing away that insanitary area. The death-rate in that area was upwards of 40 per 1000. What struck the Committee most of all was that whilst they were spending this money there were other unhealthy areas in London actually being constructed, which they might be called upon to destroy. There are in some parts long parallel alleys varying from nine to twelve feet wide, having on either side little two-storey houses, very old and completely worn out, and the leases of which have run out. Under the Housing of the Working Classes Act they were being closed, but under the old Building Acts there was nothing to prevent the speculative builder building houses in these alleys to the height of 90 feet. He would certainly go much higher than the present two storey buildings without widening the alleys. Just look what that means. This is a clause in the Housing Act. It says that "where it is shown that the narrowness, closeness, or bad arrangement of streets or houses within such area, or the want of light, air, or ventilation are dangerous or injurious to the health of the inhabitants," it is the duty of the Council to clear that area at the public expense, to pay compensation to the owners and occupiers, and after having reduced it to bare land to reconstruct streets with proper dwellings, so that whilst they were acquiring one insanitary area for clearance purposes, these other areas were being built elsewhere which actually came under this very clause, and they could be called upon to destroy houses that were being built strictly in accordance with the Building Act then existing. On pointing this out to the Building Act Committee, the result was the introduction of these sanitary clauses into the Bill. If we

take the case of dwelling-houses the Housing of the Working Classes Act requires that any house unfit for habitation shall be closed by the magistrate, and under certain conditions a demolition order should be obtained for it. But the Building Act allowed that houses so closed might be rebuilt in an even more insanitary condition than those pulled down. There are many courts in South London where the houses are built against commercial buildings, with no back yard or back windows. A family is living in every room, the water-closet, laundry, &c., is in the basement, and you may imagine the result of the effluvia going up through the house, there being no through ventilation. If we closed these buildings, the old Building Act allowed them to be put up again even worse than before, because they could be built much higher. This shows the importance of those clauses which require a space of 150 square feet at the back of dwelling houses and 10 feet depth from the front to the rear of such space, which increases in depth as the height of the house increases. If we go from these old houses to those quite recently put up, you will find there are blocks of artizans' dwellings five storeys and more in height, with, in some cases, only six feet between the back wall of the house and warehouses 60 or more feet high; those were built in accordance with the old Building Act. There are even worse cases than that. In one case a man has managed so cleverly that he has only left three feet free behind a block of dwellings, and has covered that space with a balcony of three feet, so that if the owner of the neighbouring land had put up a back workshop, as he was entitled to do, all light and air would have been excluded altogether; he had made up his 100 feet by leaving spaces at the side of the building. He had also pulled down two old houses and put up one big block on the site of the two, and still only had to leave the 100 foot space. These cases coming before us one after another, showed us the necessity of getting the old Building Act altered, and on that account we urged upon our friend, Dr. Longstaff, to undertake this great work. We have, however, not yet reached the bottom of the difficulty. There is another question which should claim your attention and serious consideration as a Sanitary Institute, viz., that in many of these areas you cannot destroy the houses and put back under sanitary conditions the same number of people on the ground as those you have displaced. The problem is—what are you to do with the balance of people whom you cannot put back on the ground? Workmen, when proper means of conveyance are provided, will live outside London. You can see this at Walthamstow where there is, compared with the central districts, an ideal condition of existence. He thought it would be a very good thing on the part of this Institute to seriously take into consideration this very formidable difficulty, and to try to devise some practicable way of overcoming it.

Mr. T. Blashill (Superintending Architect of Metropolitan Buildings) said: We have to prepare ourselves for an entirely new state of things, and that will take up our Christmas holidays. He was not so satisfied with the Act as perhaps he ought to be. Any-

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one familiar with continental cities, whether of the older type or of the new type, will be much dissatisfied with it, and will listen with very little appreciation to such remarks as fall from our architect friends as to hardship upon owners in respect of width of streets, back areas, &c. It is like another world to get into such a city as Berlin, where, instead of streets of this beggarly width of 40 feet, you get streets 150 feet wide, and on going to the suburbs you lose the street in the horizon. Some of the witnesses upon the Bill took a strong view as to the non-necessity of carrying party walls above roofs. He had no opinion on the subject, but listened to those who had an opinion, and was very much impressed with the evidence of Sir Eyre Shaw and with that of the present chief of the fire brigade. They gave their evidence very strongly in favour of the system. What he wanted to know was the experience of fire experts when there was no party wall. In every large continental city that he knew they had a party wall where a party wall is necessary, but it is exceedingly rare to find two houses together of the same size, as here, and if one house is higher than another the fire cannot easily communicate.

Dr. LONGSTAFF, in reply, said: Mr. Boulnois spoke of the gasometer. This was not a building, it was a structure; it was not, however, a temporary structure, and he was afraid the London Building Act did not touch it, unless the line of frontage be exceeded. Our original Bill defined both "building" and "structure." But the legal mind has a horror of definitions, and conjured up no end of bogies as to what would happen if we defined what was a building. For instance, it was pointed out that according to our definition (drawn up by the Institute of Architects), three sticks stuck in the ground with a hat upon the top would constitute a building. So they struck out the definition, and we are no wiser than before. Mr. Boulnois complains that this volume does not contain all the law relating to building in London, but he is not likely to get it in one volume for some time to come. Dr. Longstaff objected to one point in Mr. Hall's remarks. We are much indebted to the Institute of Architects and to Mr. Hall as Secretary of their Special Committee, and shall agree that a great deal was done by coming to as many agreements as possible out of court, and quite 100 clauses were thus disposed of; but when he tries to claim for the Institute of Architects that they initiated the new Building Act, that the Institute set the Government right when they were lagging behind there, he must differ from him. He (Dr. Longstaff) was appointed in 1889 a member of the Building Act Committee, and within a few weeks he was also appointed a member of the Sub-Committee on the Building Laws, which began its work at once. For six long years did he labour on this Bill, which has now become law, and therefore must claim precedence. Mr. Hall complains that originally we wished to set back all buildings. Mr. Banister Fletcher shows what injustice may arise from our only setting back some of them; we must set one objection against the other.

As regards ventilation of courts, the Institute and the Council were pretty nearly at one as to what was required, and the Council had very precisely fixed what was meant to be provided in the way of ventilation, but the Committee put in the words "adequate ventilation," without stating that the Council or anyone else should judge of the adequacy. The sill of the window objection did occur to the Council, but it will be found that it is limited in its operation by other clauses in reference to windows of habitable rooms, not completely but to a large extent. It was thought that it was rather hard to measure the line from the ground floor of the room and not to give in these three extra feet. As regards the space and the diagonal line, of course if men are perverse enough to do so we shall have some interesting structures, but the diagonal line only limits the space within which you *may* build, and as a matter of economical construction in the great majority of cases it will pay to make such sets-off in the building that you can carry your walls straight up. The Council could not deal with these very extreme cases. The reply to Mr. Hall is also an answer to Mr. Bruce's criticism, "that his committee urged his friend Dr. Longstaff to do this," but his friend Dr. Longstaff had his Bill in a very advanced state before the urging began. As regards the two sides of a narrow street, what Prof. Fletcher said is very true. This only shows the equity of the universal rules of the original Bill. To a certain extent, however, he has unconsciously exaggerated the bogey he has raised, because these narrow streets occur chiefly in very small properties, and under the provisions of this Act it will not profit individual small owners to make reconstructions, but as a necessary consequence people building on such property will have to deal with it in blocks of some size, so that both sides of the street will probably be dealt with at the same time. The object of the County Council was to prevent, as Mr. Bruce put it, the making matters worse than they are now. The sensible man will take care to acquire both sides of the street, and so be able to make the best use of the land.

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DRY METHODS OF SANITATION.

By G. V. Poore, M.D., F.R.C.P.

Read at Sessional Meeting, February 13th, 1895.

In the remarks which it is my privilege to make this evening upon "Dry Methods of Sanitation," I shall endeavour as far as possible to avoid controversial matters. We must all of us admit that there are circumstances which may compel us to use dry methods, no matter what may be our predilections or prejudices, so that in the first instance I will ask you to consider the question of the best methods of carrying out dry sanitation in circumstances where it is an absolute necessity.

We have come to think that there can be no cleanliness without soap and water, and it may be necessary to remind you that the nomad Arab cleanses himself with the sand of the desert, that polished floors redolent of beeswax and turpentine are at least as wholesome as those that are scrubbed and have their crevices filled with a soapy slime; and that one of the best ways of washing a flannel shirt is said to be to hang it in the sun and beat it thoroughly with a stick. Necessity is the mother of invention, and were there a water-famine to-morrow I have no doubt that those who were minded to be cleanly would somehow manage to be so.

There is no denying that dry methods of sanitation are, in this country, where water is plentiful, far from popular. Dwellers in cities want to be rid of matters which have no value for *them* as individuals, and the luxury of having a scavenger "laid on," who can be set at work by merely turning a tap, and who, albeit that we pay handsomely for his services, does not hang about to be "tipped," are undeniable. Then again, our scavenger is a very strict teetotaller and never strikes, although occasionally he is "frozen out." Many of us during our unprecedented frost have, so to say, been the victims of dry methods, and of "water" closets, so called, on the principle of "Lucus a non lucendo."

But let us pass at once to the subject on hand:—

If dry methods of sanitation are to be successfully carried out it is necessary to bear in mind the principles which underlie them.

The change which is produced in excrement when mixed with earth whereby the excrement is humified, *i.e.*, changed to something which is indistinguishable by our senses from ordinary garden mould, or humus, is due to the action of fungoid organisms. Some of these belong to the "mould" fungi, such as penicillium and saccharomyces, while others are due to the schizomycetes otherwise known as bacteria, bacilli and micrococci.

A very important organism or class of organisms in this connection are those which bring about the nitrification of nitrogenous matters, whereby they are oxidised and made soluble so as to be readily absorbed by the roots of growing plants. I prefer, however, to use the word *humification* in place of nitrification, because it is not likely that nitrification is the sole change which takes place, and it is at least highly probable that many of the fungi which grow in nitrogenous matter play a very important part in producing fertility and in feeding higher plants. The intestines of animals swarm with bacteria and allied bodies, and it may be assumed in the absence of evidence to the contrary that excrements carry with them, so to say, in the form of bacilli and bacteria, bodies which help in their subsequent humification.

Which of us has not noticed the excrement of a dog, evenly covered with exquisitely graceful stalks of fungus as with a crop of erect white hairs. The greatest of all human observers must have noticed this for he makes the Queen say to Hamlet:

> "Your bedded hair, like life in excrements,
> Starts up and stands on end."

Ordinary humus contains such organisms in countless numbers, but it is probable that when excreta are mixed with sterile bodies, such as ashes, the necessary organisms are in part supplied by the excreta themselves or possibly gain access from the air around.

In order that humification may take place two things are necessary.

1. The matter must be tolerably dry—absolute dryness checks the process, so does excess of moisture. It is stated that about 33 per cent. of moisture is the amount with which the humifying change is most rapid.

2. The access of air is necessary because the organisms which produce humification are ærobic, and, as much of the change consists of oxidation, it is evident that the free access of air is essential.

With regard to the question of the necessity of access of air I may mention what has occurred at my garden at Andover during the late Autumn, 1894. Those of you who have read

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my little book, "Essay on Rural Hygiene," may be aware that in this garden human excreta have been systematically buried superficially for the last ten years. Ordinarily in the Summer and Autumn (for the quickness of the process largely depends upon temperature), humification takes about three weeks, but this year when the rain was incessant and the garden so to say was drenched and soaked, the process has taken very much longer, and by turning up the close wet soil one has been able to identify fœcal matter which had been deposited two or more months previously. The reason of this I think is to be found in the fact that owing to the rain the humus had become close and sticky like clay and every mass of fœcal matter had become completely enclosed, one might almost say hermetically sealed with a covering which in consistence resembled an impervious doughy pudding crust.

This delay in the humifying of excreta in an exceptionally wet season is of great interest, and it must be borne in mind that the excreta *were not washed out of the soil* as might have been expected, but were stored up until an amelioration of the seasons enabled them to be utilised. It should be remembered that although the excremental matter was plainly recognisable by the eye it gave off no foul smell, and the nose could be held quite close to it without offence.

Seeing that moderate dryness and free access of air are essential for humification, it becomes necessary so to construct our receptacle that these ends may be attained.

This end is not attained in an ordinary pail because all the urine is retained; there is an excess of moisture, and the mixture becomes putrid and sloppy, unmanageable and offensive.

The best method of treating excreta is to allow them to be deposited in the "dry ditch," suggested by Mr. Richardson of Clifton, and of which a figure is given in the last edition of "Rural Hygiene." In this arrangement the seat is raised on two or three steps, and the excreta are caught on a slightly sloping concrete floor; the excreta are freely exposed to the air, and the urine flows away down the slight slope and is caught by an absorbent material, of which the best is garden humus.

With this arrangement no putrefaction takes place. It is not a matter of much practical moment whether or not earth be thrown into the dry catch after the excreta, because the arrangement ensures that offensiveness is reduced to a minimum.

If earth be used this humification will go on in the vault itself, and the longer such a vault is used the better it will act, always provided that moderate dryness and free access of air is ensured.

I speak with great confidence as to the success of this arrangement, and with an experience of two years' standing. With a dry catch of this kind used, let us suppose, for the lowest class of property and with daily removal of the excreta, the bulk and weight of the excreta is reduced to a minimum; there is no sloppiness or putrefaction. Collections and transport are easy, and the work is, with suitable tools, not repulsive. If we adopt the estimate of Parkes that the solid excreta averages for both sexes and all ages not more than 2½ ozs. per diem, then the household of five persons would provide considerably less than 1 lb. weight per diem.

Now a dry catch may in country places be used with the additions of dry earth, and where the householder has a garden he can have no difficulty in managing everything for himself, and must be little better than an idiot if he allows any sanitary authority to rob him of the finest manure the world produces, the excreta of the "paragon of animals," and withal the most highly fed.

Where the sanitary authority is responsible for the disposal of excrement I believe it will be found more economical to carry the excreta to the earth than to take the earth to the excreta.

If there be cultivable land at hand, and the nearer such land is to the houses the better, I believe the best course to pursue is to bury it daily in superficial furrows, and I say, without any hesitation whatever, that the shallower such furrows are the better. In my experimental garden at Andover I have pursued the method for more than ten years, and have dealt with the excreta of about 100 persons with the best results and with no offence. My garden is in the middle of the town and only a few yards distant from my cottages.

If there be no cultivable land at hand, then the excreta would have to be taken to a rough shed (sufficient to keep off the rain) and mixed with earth. The process of humification would be completed in three months, and the humus thus formed might be used over and over and over again *ad infinitum*. The great advantage which follows from the scientific use of "dry methods" is the continuity of the process. Nature turns all the excrement to humus, and humus is acknowledged to be the very best purifier of offensive nitrogenous matter which the world affords. The dark humus which is found everywhere, and which provides for all our needs in this world, is nothing but excrement which has suffered a natural transformation brought about by a process which is purely biological. The oftener such humus is used the better it acts and, further, it slowly increases in bulk. There can be no doubt as to its horticultural value,

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and if the authority cannot use it the neighbouring farmers and gardeners would gladly do so. One of the difficulties connected with the dry-earth system is the difficulty of procuring earth, but from what I have said it is evident that an initial store of earth sufficient for six months' use, if judiciously, carefully, and scientifically used, would for ever take away the necessity of providing a fresh store.

This continuity of action is a most important matter, and one which has been hitherto almost wholly unappreciated. This arises from the fact that those who have not carefully studied these dry methods are unable to believe that what I have stated is really true. That it is absolutely true I have no doubt whatever. Every Sanitary Authority should have a garden of its own for the purpose of practically demonstrating the excellent results obtained by using this "dry" material as a manure. Such a garden if properly cultivated could not fail to be both beautiful and productive, and, if managed on the profit-sharing principle, would not fail to yield at least enough to pay wages. Such a garden should not have the customary notice, "No admittance except on business," but it should be the business of everybody to walk by it or through it, while wending to and from their daily work, and in so doing receive an object lesson which would do more to enhance the health and prosperity of the country than any number of Board Schools and Free Libraries. In the last editions of "Rural Hygiene" I have given some statements as to the financial results of my garden at Andover, which I think will be regarded as satisfactory. My experiments point to the fact that 600 square yards is enough for the disposal of the excreta of about 100 persons per annum.

The causes of the ill-success of the Pail System appear to me to be in large measure due to the great weight of the material to be carried, and, in consequence of the exceeding foulness of the material, the great distances which it has to be carried.

If the material removed be buried superficially every day with a view to cultivation and production the land to which it is removed *cannot be too near to the houses*. This may seem a strong assertion, but I make it without any hesitation whatever. Should the necessity ever arise I feel sure that all the parks and square gardens might be used in the manner I have indicated for sanitary purposes, not only without offence but with a certain great increase in the productiveness of the ground, always provided that the atmosphere be not too foul (as is the case in Central London) to permit of horticulture or agriculture in any form.

Further, the initial expenses and repairs of pails would no longer fall on the Sanitary Authority, and the huge cost of

lugging about these absurdly clumsy putrefaction boxes would be at an end.

We have three specimens of municipal pails in the Parkes Museum, and these vary in weight from 40 lbs. to 50 lbs. The 50 lb. pail, which is 18 inches in diameter and 15 inches deep, weighs, when filled with water, 187¼ lbs.

If by the help of two men, a horse and a larry, one has to take, in addition to the excreta, fifty pounds weight of galvanised iron, or wood and iron, a mile each way, the expense becomes huge, and anything like a daily removal is impracticable; but if one has to transport a pound of solid excrement a few hundred yards only, then the problem is a very different one.

Any Sanitary Authority which adopts "dry methods" should endeavour to arrange for a daily removal. I am no advocate of "conservancy," but would rather see the immediate utilization of the excreta. It is only by immediate burial that one gets the full manurial value of the excreta.

The burial must be done with a view to the cultivation of the land. *It must be superficial.* The excreta must be merely covered with the earth, no more. Furrows half a spit deep are ample. It is in this way only that one insures the oxidation of the excrement and the protection of the wells.

It is the almost universal custom to bury night soil deeply, and I could quote many instances in which excreta have been buried three or four feet deep and have been exhumed some months later unchanged and still foul. If they be buried deeply the farmer or gardener gets no benefit and the wells are endangered. The farmer be it remembered spreads his dung on the surface of the ground, with a maximum exposure to light and air and then ploughs it in; nothing could be more truly scientific.

We hear that in India, in spite of the earth system, typhoid is rife, and the opinion is very general there, that typhoid spreads through the air. I have never been in India and am not competent to express any opinion, and this evening in the presence of our illustrious chairman, Sir Thomas Crawford, I should certainly not dare to do so. But I have heard that in some places in India the excreta are *deeply* buried, and if this be the case it appears to me that if the ground gets deeply fissured during drought that the torrential rains which follow may very well wash the too-deeply buried and unchanged excreta into the water sources.

If excreta are to be used for agricultural purposes, no chemical antiseptics must on any account whatever be mixed with them. Antiseptics are a source of serious danger to the agriculturist. The best antiseptic for such a purpose is earth.

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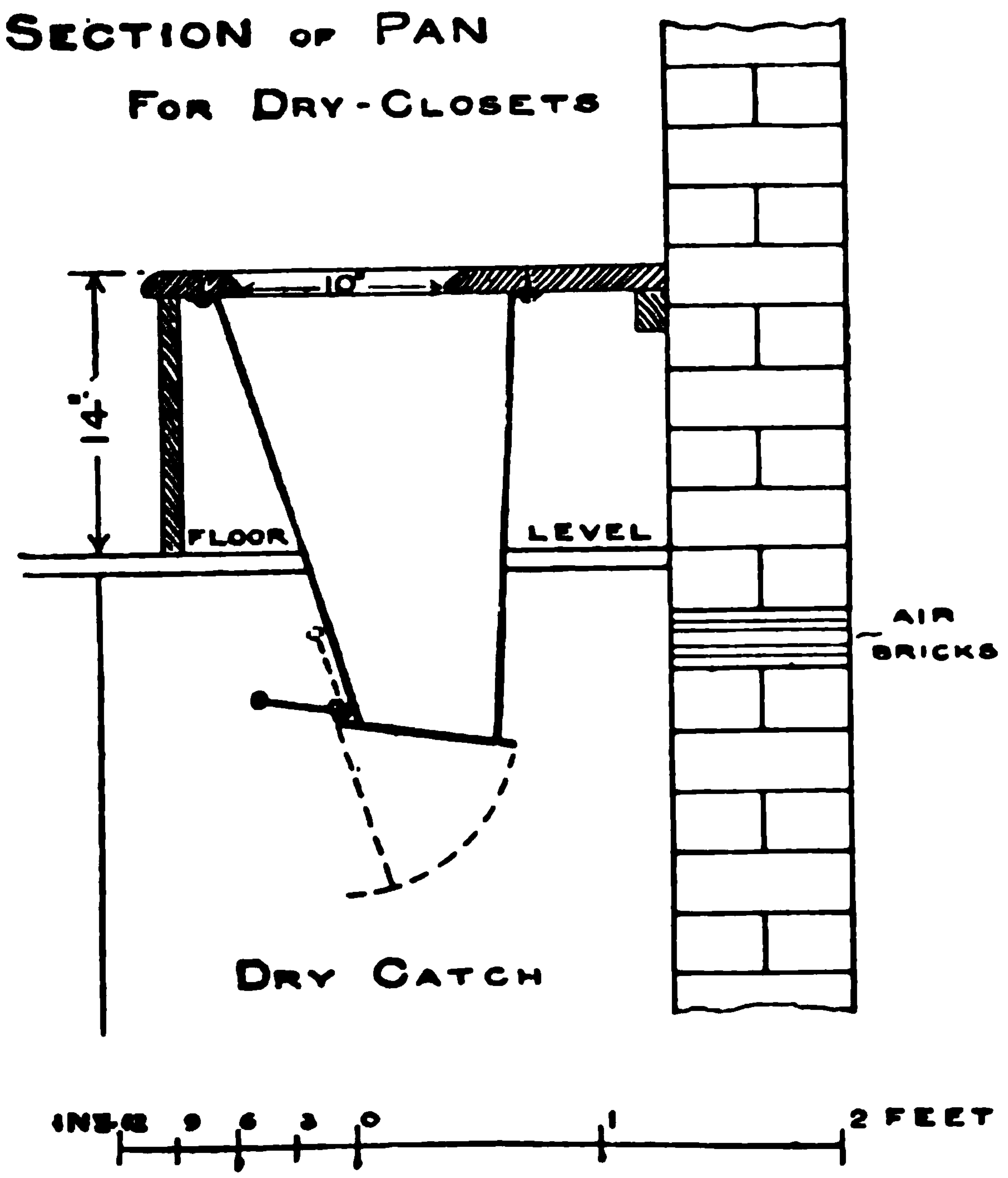
Again, the manufacture of poudrette or any plan for cooking fœces is a mistake, because the microbes which are a probable advantage to the farmer are thereby destroyed.

The horrors of this process are more readily imagined than described. I once heard a gentleman in this room characterize some sewage works which he had visited as a "Devil's kitchen!" I think even his rich vocabulary would have been bankrupted had he seen, as I once saw in a northern town, a number of men engaged in supplying a huge receptacle with the week-old putrid contents of pails, the first stage towards their ultimate desiccation.

In order to overcome the dislike which many ladies have to earth-closets, I have devised a pan which has been made for me by Messrs. Righton, of 376, Euston Road.

Pan for use in Dry Closets.

This pan is not intended for ordinary earth closets, but for those cases only in which the closet is provided with an ample

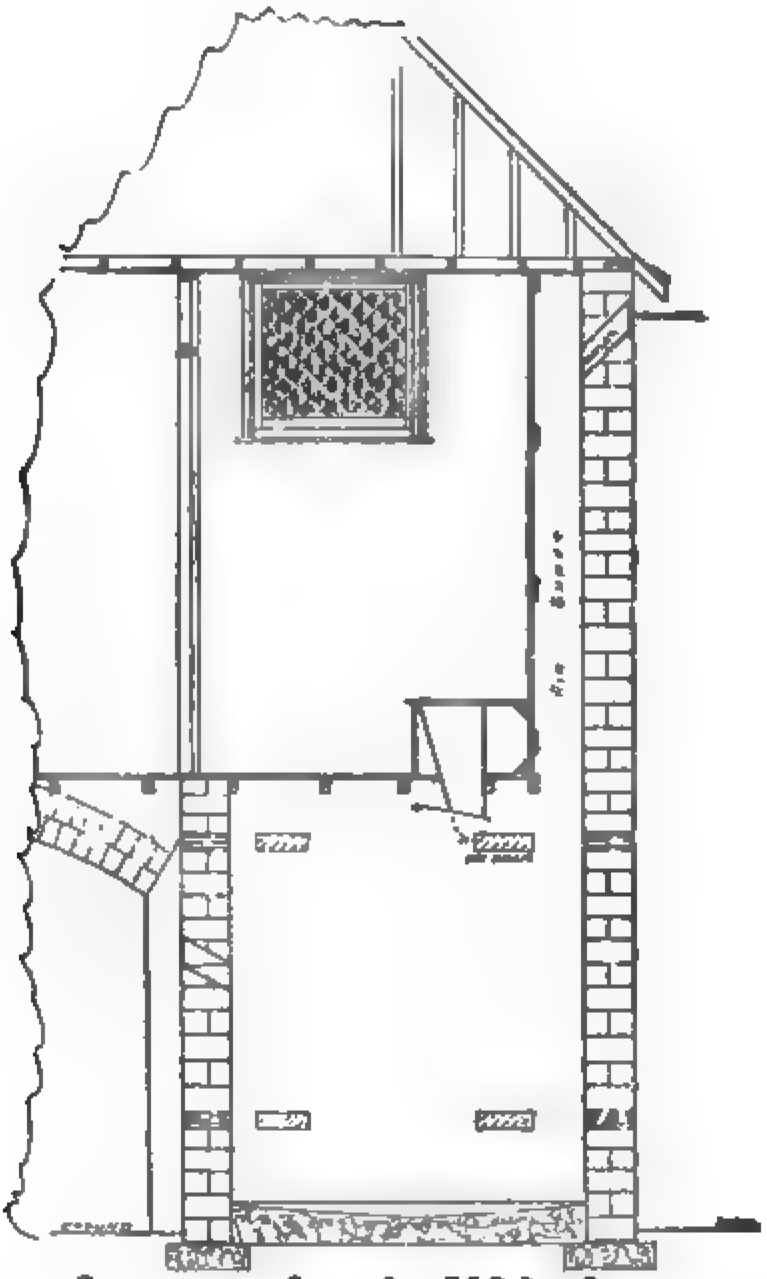


receptacle or "dry catch" beneath it. It is especially applic-

able for dry closets which are approached from the bed-room floor of a house.

Two illustrations are given, one of these shows the details of the closet seat and pan, while the other gives a section of an actual closet (separated by a lobby from the main structure of the house) with the dry catch beneath and the apparatus in situ.

The pan is provided with a flap which acts automatically by means of a counterpoise. The lower end of the pan is beneath the floor level and projects into the vault beneath. The earth



SECTION THROUGH CHAMBER FLOOR E.C. & DRY CATCH.

is thrown into the pan by means of a scoop having a handle 18 inches long, so that, when necessary, the flap may be cleared by means of the scoop.

The apparatus is intended to increase the "decency" of dry

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closets and to make them more acceptable to ladies than at present is the case. The ends attained by means of the flap are two, viz., (1) That the dejecta drop out of sight, and (2) That up-draught is prevented. The flap works freely in a slot and can be unslipped with ease and be perfectly cleaned with a stiff brush occasionally.

It is to be noted that the closet seat is only 14 inches high, which ensures that the dejecta fall vertically and do not soil the back of the pan. The front of the pan is oblique, while the back is nearly vertical. The front is set 1 inch only from the front edge of the seat, while the back is set 3 inches from the back of the seat. This arrangement together with the comparatively low seat make a soiling of the back of the pan practically impossible.

The earth for this closet is kept in a bin on the left-hand side of the seat and the earth is thrown into the pan by means of a scoop in order that much or little earth may be used in accordance with requirement. The bin for earth is filled by means of a hopper which is accessible from the outside, and is so arranged that the person filling the hopper and any chance applicant of the closet cannot come within sight of each other. The hopper and bin hold a very large quantity of earth, and there is no necessity for traffic through the house with either earth or dejecta.

But, I hear some of you say "it is all very well to tell us that if excreta be kept dry they will ultimately humify and not putrefy, but how is this to be done and what arrangement do you propose for dealing with the urine?" This leads me to speak of the dry methods of urine treatment.

You are well aware that the use of absorbent material for taking up urine is no new idea. It is the foundation of the Goux and similar methods which have been used in conjunction with the pail system in northern towns. The idea was a good one, but the absorbent not being exposed to the air the urine was not subjected to those conditions which are absolutely essential for its proper treatment.

We all know that urine if properly used is a valuable manure, but we also know that if crude urine be given to plants its first effects are fatal to growth. Urine when used for agricultural purposes is first absorbed by straw or other absorbent material, and is then spread by the farmer on the surface of his land, with the best results and with no ill effects whatever. There can be no doubt that nitrification takes place as was proved by Boussingault more than a century ago, when he issued his "Instructions for the establishment of nitre heaps,"

by mixing ashes, straw, and animal refuse in loose heaps and watering them with urine. In this way our thrifty neighbours, the French, were supplied with salt-petre for military purposes.

I would ask you to think of the enormous quantity of urine which is voided daily on the surface of our roads and streets, and without producing any foul odour, because it is absorbed, evaporated and freely exposed to the air. Professor Macfadyen tells me that a horse voids about 30lbs weight of fœces and a gallon of urine per diem. In our treatment of urine we should clearly imitate nature. If it be kept in bulk it becomes foul beyond expression. If it be mixed with water and be allowed to stagnate, it becomes scarcely, if at all, less foul than when it stagnates unmixed with water. If it be mixed with soap-suds and be allowed to stagnate, it also becomes foul. Anyone, however, who will try the experiment of throwing bed-room slops—alkaline soap-suds and urine—day after day on the same plot of humus, will be astonished to find how long he can pursue this course without causing any offence.

My experiments with urine were begun in 1890 and are still in progress. I will shortly recapitulate what I have been doing, leaving those who desire more details to find them in the "Essays on Rural Hygiene."

The first experiments were made by the slow filtration of urine through garden mould contained in a conical metal vessel, 2 ft. 6 in. in length and 1 ft. in diameter at the base. The result may be briefly stated as follows:—That the filtrate obtained was, *when fresh mould* was used, always of lower specific gravity than the urine added. The maximum results being 1·003 for the filtrate, while the urine had a specific gravity of 1·024. This filtrate had no tendency to putrefy, and could be evaporated to dryness without giving off any offensive odour. The filtrate although derived from urine was no longer urine.

When earth, which had been previously used for the filtration of a relatively large quantity of urine, was used a second time, after an interval of some weeks, for the further filtration of urine, the filtrate was always of higher specific gravity than the urine added owing to its having dissolved nitrates and probably other soluble salts which had been formed by the interaction of the mould and the previously added urine. The specific gravity of the filtrate was 1·035, but analysis showed that the urea had completely disappeared, and this filtrate like the others showed no tendency to putrefy and could be evaporated to dryness without offence. When earth which had been previously used was heated artifically over a gas-flame before being

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used a second time the filtrate had a specific gravity of 1·041 and contained a large percentage of urea. This was due to our having sterilized the mould by heat.

This experiment is a demonstration of the fact that when urine is thrown upon the surface of the ground it must have the greater part, if not all, of the organic matter taken out of it or transformed before it reaches the water-sources.

In these experiments in which only about ·75 cubic feet of earth was used, the urine was added in small quantities daily, so that the urine was in contact with the earth for some days before it appeared as filtrate. It must be remembered that the sides of the filter were impermeable, and that the lower portions of the earth which could not be stirred soon got saturated. The experiment in short was a very poor imitation of natural conditions. I have filtered urine through a variety of things, such as hay, dead leaves, &c., with the result of getting a mouldy filtrate. The following experiment is of interest.

I filled the metal filter with pieces of old cement stucco which had burst away from the wall of a house during a frost, and between July 24th and October 9th, 1893, 246 ozs. of urine had been added (it was added at very irregular intervals, owing to August and September being vacation months). The filtrate was large in quantity (190 ozs.). It was of a very pale yellow colour, with a specific gravity never higher than 1·005. This filtrate was placed in a bottle and was frozen solid during the winter of 1893–94, and again frozen solid last week. Some of the filtrate was shown. It has a specific gravity of 1·0015, and by the eye and nose is indistinguishable from water. After the frost of 1893–94 it deposited a copious white precipitate of lime salts (?). The precipitate was unfortunately lost, so that I am not sure as to its composition, but it underwent no change when dried and incinerated and did not effervesce on the addition of acid. After the precipitate had fallen, the liquid, which was left in a white bottle exposed to the light, became permeated by a green algoid growth and then a further slight flocculent precipitate fell. Please remember that this clear watery fluid which I show you is the descendant of 246 ozs. of pure urine filtered through broken stucco. Doubtless the stucco contained in its pores a large quantity of microbes which brought about the remarkable change.

Rather more than a year ago Mr. W. Jacomb-Hood, one of the engineers of The London and South Western Railway, consulted me as to the erection of some dry-catch earth-closets in the engineers yard at the Twickenham Station. He had read my book and had seen the results of my experiments at

Andover, and therefore knew how well the system answered. "But," said he to me, "we must have a urinal, and how can that be managed without water?" I advised him to use an absorbent material in a trough having a triangular section. In this yard there was plenty of sawdust, and therefore sawdust (from deal and pine) was employed. This urinal, which is used by a fluctuating number of men (about 150), has answered splendidly. I inspected it last Friday (five days ago). It had been in use eight weeks without being changed. It is stirred, however, every day. The amount of filtrate is almost nil and the only odour perceptible is one of sawdust. The dry-catch closets also have been a very great success, and have become exceedingly popular with the men employed at the works, and on the trains which call at the yard. I must say that these closets and urinal were in very great contrast to the frozen urinals and heaped-up closet pans, which, during the late severe frost, were common everywhere. The success has been so great that the system is to be introduced at an important country station. The arrangements at Twickenham have been in use for eleven months. There is a man specially told off to look after them, and the contents of the dry-catch closets have been put upon 15 rods of adjacent garden ground, and the whole of this ground has not yet been utilized. The crops from it have been good.

When I recommended sawdust for use in dry urinals I told my friend that I had no practical experience of it, but I saw no reason why it should not answer, and I pointed to the fact that its universal use in butchers' shops showed how great was its antiseptic power. My only misgiving with regard to it arose from the fact that it is not in favour with agriculturists, and is regarded as a dangerous application to land, doubtless because the resin and turpentine contained in it check the growth of the microbes in the soil.

I began experimenting with sawdust in December, 1893, and I will give you some of the results. An experiment was made with 6 lbs. of sawdust in the metal filter, to this was added, between February 6th and 18th, 1894, 187 ozs. of urine, while 17 ozs. of filtrate was obtained. The sawdust was then removed and hung up to dry in a cheese-cloth bag in a shed. It was used a second time between April 5th and 21st, when 247 ozs. of urine were added and 72 ozs. of filtrate obtained. The sawdust was removed and dried as before. It was then used a third time between May 21st and July 1st, when 373 ozs. of urine were added and 157 ounces of filtrate obtained.

On January 20th, 1895, this same sawdust was placed in a small hamper. It was apparently absolutely dry (a

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sample of its then condition was shown), and it was found to weigh 7 lbs., so that after the addition to it of 807 ozs. (more than 50 lbs. weight) of urine it had only increased 1 lb. in weight. Some 15 lbs. weight had been recovered as filtrate, 1 lb. had been retained by the sawdust, while 34 lbs. ($68\,^{\circ}/_{\circ}$) had evaporated.

To this sawdust in a hamper 223 ozs. of urine were added between January 20th and February 4th of this year. The sawdust has been frequently stirred, and no filtrate has been obtained. (A sample of this original 6 lbs. of sawdust to which 1030 ozs., or over 60 lbs. weight of urine, had been added in the past year, was shown.) It is still moist, but you will observe that it is absolutely devoid of foul odour of any kind, and after drying we shall be able to use it again.

These rough experiments seem to point to the fact that these dry methods of treating urine like the similar methods of treating excreta are continuous in their action. One cannot be quite sure of this, but arguing from analogy it seems highly probable. I can positively answer as to its effectiveness when used four times in twelve months.

Seeing that the metal filter effectually prevented evaporation except at its upper end, I tried a filter like a cook's jelly bag, and made of flannel. This was placed in my room at University College, and between May 29th and July 26th, 39 lbs. weight of urine was added, and less than 3½ lbs. of filtrate was obtained, so that 35½ lbs. of urine was either retained or evaporated.

My final opinion is that in order to get the most work, so to say, out of sawdust, it must be placed in a receptacle which is permeable to the air, and the sawdust must be stirred occasionally. An ordinary three-dozen wine hamper three parts filled with sawdust, and its bottom raised off the ground so as to get a free circulation of air beneath it, is probably about the best and cheapest form. Such a basket with a double charge of sawdust, so that one-half may be drying while the other is being used, would be capable of dealing in *perpetuo* possibly with a large amount of urine.

My mixtures of sawdust and urine have never heated, in fact the themometers which I always keep in them have almost invariably marked a temperature less than that of the air surrounding them. This is due probably to the evaporation of ammonia and water which cools the mass. The evaporation which takes place is, however, very considerable. Thus 9 lbs. weight of oak sawdust which had retained 25 lbs. weight of urine was, when it was placed in the cheese cloth bag to dry on November 25th, 1894, found to weigh exactly 24 lbs. On

December 29th (34 days later) it weighed 17 lbs., having lost 7 lbs. weight by evaporation in weather which was exceptionally damp and foggy. On February 2nd it weighed 13 lbs., and between February 2nd and February 8th, during a frost of most exceptional severity, it lost a further ¾ lb. of weight. This goes to show that even during the most unfavourable time of the year the evaporation is considerable and continuous.

These filters (except on one occasion to be presently mentioned) have never been in the least offensive.

The filtrates obtained have been very different from those obtained from earth. They have been of high specific gravity (1·030 to 1·040) thick, cloudy, not cleared in the least by filtration through blotting paper, nor have they deposited sediment on standing. They froth like beer or porter, and are generally slightly alkaline in reaction. They smell like sawdust and apparently contain ammonia and resin. They have great cleansing power, and I have found them invaluable for polishing old carved oak.

Oak sawdust differs from deal sawdust in this, that it gives a far darker coloured filtrate (like porter with a golden froth), and when not too moist becomes permeated with a fungoid growth, which according to Mr. George Murray of the British Museum, consists of penicillium and saccharomyces. I have never seen any appearance of fungoid growth in deal sawdust.

The filtrates have never been in the least offensive, except upon one occasion which is deserving of special mention. Between May 21st and June 17th, the metal filter filled with sawdust had had 307 ounces of urine added to it, while only 18½ ounces of filtrate had been obtained. All filtration had ceased and the filter was placed in the sun under a south wall. The last week in June, 1894, was very hot (the only really hot days in that exceptionally cold summer). On June, 26th, 9 days after the filtrate had ceased, the filter began to yield drops of filtrate, and during the last four days of June it yielded 134 ounces of filtrate having a strong smell of herring brine due I suppose to the presence of tri-methylamene. This filtrate becomes of great interest in relation to Dr. Macfadyen's and Dr. Blaxall's paper on thermophilic bacteria which appear to be developed only at exceptionally high temperatures, and to give rise to foul products. It seems certain that owing to the development of these bacteria, there must have been some softening actions on the sawdust, leading to the yield of the foul filtrate which was yielded in large quantities, and only during the great heat.

I shall hope to obtain further information on this point when next we are favoured with really summer temperatures.

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Among absorbent materials which may be suitable for the dry treatment of urine one must mention peat dust, but as yet I have not been able to make any experiments with it. Dr. Dempster has shown that peat even when sterilized is strongly antiseptic, and for this reason it is not in much favour as a manure.

I fancy that with a little coaxing any dry matter, such as dust and sweepings and old paper, might be made to absorb urine with advantage. I have tried paper and have filtered 31 lbs. weight of urine through 2 lbs. weight of crumpled paper, mainly derived from old Bradshaw's Guides. The first filtrates obtained were exceedingly foul, and could be smelt distinctly at a distance of many yards. These were returned to the filter, and in the course of a short time all became sweet, and the paper which became sodden and compact and permeated with fungus soon acquired the power of sweetening urine, and still possesses it. My belief is that any absorbent material would soon acquire this power by virtue of the growth within and upon it of the necessary microbes, and that the power once acquired would be, with careful management, more or less continuous.

I have tried the manurial value of the urine-soaked sawdust, and I am able to say that, having spread a considerable quantity over one-half of an oval flower-bed last summer, that the flowers on that half were fully as luxuriant as the others. There was no poisonous effect certainly, and that being the case it must have had some manurial value.

Farmers and gardeners have long known that sawdust and peat require a long term of "ripening" in the open air before they are put upon the land. That, ultimately, they do good all seem agreed.

While dealing with dry methods of sanitation, one must not forget that malodorous abomination, the "hog bucket." I have in the country no hog bucket, but the kitchen refuse is thrown within a circle of wire netting with the *debris* from the garden. All offence is thereby stopped, and all this house and garden refuse humifies in course of time and becomes of great horticultural value.

The Congress organised at Liverpool in the Autumn of 1894 by The Sanitary Institute, a report of which is given in the number of our Journal issued in January, 1895, affords a very instructive view of the state of public and professional opinions as to the best method of dealing with excremental matters.

We have first a paper by Professor Roche, of Dublin, on the

danger of admitting the excreta of typhoid patients into public sewers and advocating their destruction by heat. This proposition was supported by Sir Charles Cameron, who had recommended the Hospital Boards of Dublin to employ destructors, notwithstanding that he thought that the evidence as to the general spread of typhoid by sewers was "of the very feeblest character." Dr. Marsden, of Birkenhead, and Dr. Stoney, on the other hand, considered that defective sewers were largely answerable for the spread of typhoid. Dr. Brown, of Bacup, agreed with Sir C. Cameron. Dr. Armstrong, of Newcastle, thought that sewers "were too freely blamed." Mr. Brand, of Wigtownshire, described a duplicate cesspool for disinfecting excreta which was to be attached to a small hospital. Dr. Sykes, of St. Pancras, was convinced that typhoid could be spread by sewers, and advocated the destruction of typhoid excreta. Sir Thomas Crawford stated that typhoid was rife in India where the earth system was largely used. Dr. Willoughby, of Eastbourne, thought it would be on the safe side to keep typhoid excreta out of sewers. Sir Charles Cameron, speaking a second time, alluded to the liability of sewers and house drains to leak, and his theory was that the soils themselves were to a great extent the source of the disease. Dr. Herbert Snow, of Crewe, thought that typhoid excreta should be kept out of the sewers. Dr. O'Flaherty said that if typhoid were malarious, it was merely because the typhoid had leaked out from the sewer. Dr. Watson spoke of the strange absence of typhoid in China, notwithstanding the occurrence of cholera.

There appeared to be a very general concensus of opinion that typhoid excreta should be kept out of sewers if possible. It should undergo a very thorough disinfection by heat or chemicals before being admitted to them.

Mr. Broom, the Borough Engineer of St. Helens, gave an interesting account of certain towns in which a serious effort had been made to keep the greater part or all excreta out of the sewers by means of the tub and pail system, his chief illustrations being taken from the Borough of Rochdale, where there are 18,147 pail-closets, 138 middens, and 650 water-closets for a population of 72,325. We may assume, therefore, that the solid excreta of nearly 70,000 of the inhabitants of Rochdale is kept out of the sewers. He pointed out that the death-rate of Rochdale had steadily declined, as had been the case in other big towns, and he alluded to the fact that the typhoid death-rate in his own Borough of St. Helens had declined since the introduction of the pail system. Notwithstanding the favourable nature of the statistics the system was

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condemned as dirty, sloppy, malodorous, requiring too much supervision and costing too much money (the cost at St. Helens averaged nearly 2·4 pence per pail per week), and he was of opinion that "the system is now dying out, and will again give place to a water-carriage system, which is certainly the cheapest and best mode of carriage at present possible."

In the discussion which followed, Dr. Ainley, of Halifax, said that "in Halifax the tub and pail system, instead of dying out was increasing every year, and an experience of twenty years made the people like it very much." Mr. Sadler, of Liverpool, thought the system was suitable in places where the population was sparse. Mr. Smillie, of Tynemouth, spoke of the admirable results of the pail system in his town. Mr. Platt, of Rochdale, said the pail system had been in use in Rochdale for twenty-five years and there was no disposition to give it up.

Mr. Alderman Noton, of Oldham, stated that his town was spending £200,000 on works of sewerage, and he advocated the water-carriage system. This gentleman followed with a paper on the use of sewage water for steam and condensing purposes. He stated that it had been used in some mills of which he was the chairman, and that sewage water was little liable to foul boilers; but he stated that the sewage water of Oldham was "principally slop water, as the town is worked on the pail system" (p. 677, Vol. XV).

It will be observed that Mr. Broom condemned the pail system, not on purely sanitary grounds, but rather upon the grounds of inconvenience, inelegance (if I may use the expression) and expense, especially where the pails have to be taken long distances.

With regard to the relative expense of the pail system and the water-carriage system, it is difficult to see how this can be estimated, unless water be supplied by meter, and the cost of installation and repair of water apparatus be reckoned. With water carriage the carrier is paid by the householder, and not the municipality, and the "pails" (w.c.) are supplied and kept in order by the householder, and these points must be kept in view when discussing the question of cost.

In connection with this question, allusion may be made to the elaborate statistical return and report on "Conservancy and Water-carriage Systems," by Mr. Philip Boobbyer, M.B., the Medical Officer of Health for Nottingham. This report states that, as a result of the returns from 78 towns, conservancy systems have had their day, and that in only four towns—Hull, Rochdale, Warrington, and Darwen—is their continuance openly advocated in any form. Mr. Boobbyer states that the night-

soil from 40,253 pail closets and 500 privies in Nottingham, amounts to about 50,000 tons per annum. Slop closets are advocated by Mr. Boobbyer, and he states that the Borough Engineer expresses his confidence of being able to "deal with a very much larger bulk of sewage at the Stoke farm than is ordinarily sent to it." This farm is 907 acres in extent, and whether it will be able to take 50,000 tons of night-soil—over 55 tons to the acre—must be a matter of doubt. Mr. Boobbyer states, however, that the acreage of the farm can easily be increased.

It appears from the Returns of the Registrar-General that the death-rate of Nottingham for the ten years 1883—92 was below that of the average of the thirty-three big towns, and that in 1893 its comparative mortality figure (taking the whole of England and Wales as 1000) was only 1035, its sanitary condition being inferior to six only and superior to twenty-six of the big towns. It would seem, therefore, that Nottingham is being driven to change its system more from motives of convenience and expedience than any serious defects in its health conditions.

We are thus led to the conclusion that whereas in big towns the inhabitants are getting tired of the pail and similar systems, this feeling arises from the inconvenience and alleged expense of the system rather than from any failure in its purely sanitary connection; and we are also led to the conclusion that there is a growing feeling among sanitarians that excreta may be dangerously infective and that it is at least advisable to prevent typhoid excreta from entering sewers. It must be remembered however that typhoid is an insidious disease which is rarely diagnosed in its early stages, and that the only way to ensure that it does not enter a sewer is to stop out not *some* but *all* alvine evacuations.

It is often stated that to deal with excremental matters separately from the slop water is no advantage either from a pecuniary or sanitary point of view, because:

1. Slop water is as foul as sewage composed of excrement and slops.
2. A system of sewers is necessary for the slop water, and it is not easier to treat slop water alone than it is to treat a mixture of slops and excrement.

I find, for example, in a Paper on "River Pollution," in the last number of the Journal of The Sanitary Institute (January, 1895, p. 589), by Mr. William Spinks, the following passage:

"Unfortunately, most of our towns in the manufacturing districts have very few water-closets, in fact, from inquiries I

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made a few years ago, I found they did not average more than 3 °/₀ of the whole, and that where the dry closet systems prevail there seems to be an opinion that there is no necessity for the construction of sewage disposal works as it is alleged that the sewage is only sink water and can, therefore, contain only a little of soapy and greasy impurities. Sewage is a very complex liquid, and even in towns such as these will contain, in addition to the sink water, nearly the whole of the urine (mostly from chamber slops), the drainage of stables, cow-houses, and slaughter-houses, middens, &c., &c., and it was found by the Royal Commission on Rivers Pollution in 1868 that the difference in degrees of impurity between a water-closeted town and non-water-closeted town was very slight, as will be seen by reference to the well-known table here quoted :—"

TABLE I.—AVERAGE COMPOSITION OF SEWAGE.

In Parts per 100,000.

Description.	Total Solid Matters in Solution.	Organic Carbon.	Organic Nitrogen.	Ammonia.	Total Combined Nitrogen.	Chlorine.	Suspended Matters. Mineral	Organic	Total.
Midden Towns	82·4	4·181	1·975	5·435	6·451	11·54	17·81	21·30	39·11
Water - Closet Towns	72·2	4·696	2·205	6·703	7·728	10·66	24·18	20·51	44·69

In Grains per Gallon.

Description.	Total Solid Matters in Solution.	Organic Carbon.	Organic Nitrogen.	Ammonia.	Total Combined Nitrogen.	Chlorine.	Mineral	Organic	Total.
Midden Towns	57·68	2·926	1·382	3·804	4·515	8·078	12·467	14·910	27·377
Water - Closet Towns	50·54	3·287	1·543	4·692	5·410	7·462	16·926	14·357	31·283

This table from the Rivers Pollution Commissioners of 1868 is not unfrequently quoted in support of the contention that slops alone = slops + excrement. I may be excused, therefore, if I examine it somewhat critically.

In the first place we may probably assume that this analysis was made in the days before "separate systems" were in use, and that the table without a knowledge of the amount of storm water present in the sewer, and without a knowledge of the character of the water supply of the towns furnishing the analyses is of no value whatever.

The table, however, is quoted by authors of repute who would certainly not do so unless they considered it of value.

We will therefore assume that it has a value, and taking the table seriously attempt to find out what it means. I will take the table in grains per gallon and simplify it somewhat.

Grains per Gallon.

Description.	Total Solids in Solution.	Suspended Matter. Mineral.	Suspended Matter. Organic.	Total Solids in Solution and Suspension.	Organic Carbon.	Ammonia.	Total Combined Nitrogen.	Chlorine.
Midden Towns	57·68	12·467	14·910	85·057	2·926	3·804	4·515	8·078
Water - Closet Towns	50·54	16·936	14·357	81·823	3·287	4·692	5·410	7·462

We shall all of us be ready to grant that the additions of excremental matters must be something *extra* added to the sewage, and that such extra matter must be either in suspension or solution. The fact therefore that the total solid and suspended matters is less by 3¼ grains in the water closet towns than in the midden towns, can only be accounted for by the enormous dilution of the excremental matters in the sewage. Notwithstanding this dilution we find that the water closet town sewage contains 20 per cent. more combined nitrogen than midden town sewage, 23 per cent. more ammonia, and, what is very remarkable, 35 per cent. more suspended mineral matter.

This excess of mineral matter in suspension (if we are to take the Commissioner's analysis seriously) could only be caused by the precipitation of mineral matters by the ammonia and sulphuretted hydrogen formed by decomposition of the albuminous and other organic matter. This excess of mineral matter in suspension must therefore be taken as a measure of the enormously increased putrefaction in water-closet sewage, a putrefaction probably to a great extent brought about by the millions of microbes which are provided from the human intestines with the excrement, and we must therefore assume that the increase of mineral matter in suspension is an indication that a large quantity of foul putrefactive gases has been given off into the streets and houses of water-closet towns.

If, therefore, this table is to be taken seriously, it seems to me to conclusively demonstrate that the sewage of water-closet towns is far more bulky and far more filthy and dangerous than the sewage of midden towns.

I am disposed to regard this oft-quoted table as valueless, but

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if it is to be, as it has been, used seriously by responsible sanitarians, then I think the above conclusions are fully justified.

It may be that in towns where there is an enormous amount of filthy liquid waste from manufactories the addition of water-closet waste to the rest of the sewage is a matter of no moment, and that, in Nottingham for example, the daily addition to the sewage of the water-closet waste of some 180,000 persons (say, 540,000 ozs. of excrement, 22,000 gallons of urine, and 4 acres of paper) may, on the whole, be an advantage when cost and convenience are both reckoned. This is a subject upon which, having no experience, I do not presume to speak.

But I feel bound to say that I cannot see what right the manufacturer has to have his waste material dealt with at the expense of the ratepayer, and I feel very strongly convinced that if the sewage question is ever to be satisfactorily solved, manufacturing refuse of unknown, variable and ever-varying composition, which is liable to interfere with the action of purifying microbes, must be excluded. If one can judge by the Liverpool discussions I stand by no means alone in holding this opinion.

Sewage is not to be regarded too absolutely from its chemical side. We must use our senses, inclusive of our common sense, in coming to a conclusion, and we must not pin our faith on analyses alone. When I am told that it is of little use to deal with solid excreta, because the liquid household slops alone are as foul and difficult to treat as the complete mixture, I confess I am incredulous.

When I see the housemaid's pail filled with three gallons of soapy water and perhaps a pint of urine, am I to believe that the addition thereto of five ounces of solid excrement, a second half pint of urine and a square foot of paper, will make no difference to its foulness and cause no increase of difficulty in its purification? Credat Judæus Apella! Such a statement is manifestly absurd.

Again we must remember that it is the solid excreta which constitute not only the foulest but the most dangerous ingredient of sewage, the only one which has caused widespread epidemics again and again, the one which has hung a load of debt round the neck of every municipality in the country.

The other ingredients of household slops, unlike the fœces, are little liable to contain pathogenic microbes. The urine of a healthy man is, as we all know, sterile when passed. In diseased conditions it may occasionally possess infective power, but this is a speculation rather than a practical fact which is acknowledged by the sanitarian. A large proportion of cooking water has been boiled and is therefore sterile and the same may

be said of the water in which our linen has been washed. Household slops therefore are not liable to be really infective.

They are nitrogenous, and consequently, if allowed to stagnate by mismanagement, they become very foul from decomposition, but that they are capable of producing epidemics has not yet been proved. Between excrement and slop water there is this difference, that solid excreta are foul-smelling *ab initio*, but slop water (if we except the smell of water in which cabbage has been boiled) only becomes foul if it is mismanaged.

In places which are not overcrowded a great deal has been done when the wholesome treatment of the solid excreta has been arranged for, and I feel that to neglect the doctrine that "half a loaf is better than no bread," and to discourage people from dealing with solid excreta, because they do not see their way quite clearly for the disposal of slops, is most dangerous.

One thing is certain, viz., that if the solid excreta are dealt with by dry methods the liquid sewage will be 25 per cent. less bulky than otherwise would be the case.

I feel certain that if, in our anxiety to prevent the pollution of rivers, we fail to appreciate the biological differences between excrement and slop-water we shall make a mistake, which in the end will be no real advantage to the streams. If therefore villages and places where the population is sparse make serious efforts to deal with excreta, they should have at least some breathing time allowed before the fish in their streams are deprived of the luxuries which they doubtless obtain from kitchen slops.

My belief is that household slops, provided they be not allowed to stagnate and are freely exposed to the air, and provided also that their purification is commenced on the premises where they are formed, need cause no serious trouble. My experiments in this direction have so far been most satisfactory, and perhaps at some future time the Council of The Sanitary Institute will give me an opportunity of dealing with the subject at greater length and in full detail.

There is only one other heresy with regard to dry methods of sanitation which it is necessary to combat, and that is as to the manurial value of the solid excreta when in the form of earth-closet mould. There are those who say, arguing entirely from chemical analyses, that earth-closet soil has but a poor manurial value, and they argue that it is hardly worth while to make any effort to save the excreta alone unless we can also save the urine, which is much more rich in nitrogen than the solid excreta.

This latter assertion is quite true, but I have pointed out

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that unless the urine be mixed with an absorbent material, as is the case in farmyard dung, it is a very difficult manure to use and that in its pure state it does temporary harm. That this question of manurial value is not a simple chemical question there can be no doubt. It is probably the biological rather than the chemical conditions of dung of all kinds which constitute its main value. Nobody who has really used human excrement has any doubt of its real value, and certainly some 400,000,000 of the human race would be willing to testify to its very great value.

My garden at Andover has received the excreta of about 100 persons for the last ten years, and it has steadily increased in fertility, as the photograph of my exhibit at the local flower show in 1893 will show. Last year (1894), owing to the unusual amount of rain and great lack of sun, was the most unfavourable year which I have experienced, but nevertheless my exhibit was highly commended by the judges. It is worthy of remark also that my potatoes were more free from disease than those of most of my neighbours, notwithstanding that they were grown in a damp, low-lying situation.

Mr. W. C. SILLAR (Blackheath) said that there was so much that was excellent, so much that was true in Dr. Poore's paper that he felt some hesitation in criticising it. In the midst of all our social and political agitations it must be remembered that all our industries are dependent upon agriculture, and common sense tells us that agriculture cannot prosper if we do not manure the land; yet we go on spending money and ingenuity in devising means to destroy or cast into the sea so valuable a fertilizing agent as that contained in town sewage. He could not altogether agree with the author as to the practical applicability of the dry method, except in very small communities or under very exceptional circumstances, for every one does not possess a garden or a gardener, and even there the manure would only be wanted for two or three months in the year, so that difficulties of storage would be sure to arise. Liebig had estimated the manurial value of human sewage at 8s. 7d. per head per annum—being 7d. for the solids and 8s. for the liquid. He believed this proportion to be true, and yet the author's method appeared to make no provision for the liquid portion, which is the most valuable. It is now possible with water-carried sewage to separate the clear water and preserve the deposit for agricultural use. From the sewage works at Kingston they were even sending this manure all over the country, and even as far as Barbados. With such means at our disposal he did not see the necessity for superseding the water-carriage system, which had at least its great convenience to recommend it.

Mr. Charles Mason (London) instanced the town of Nottingham, where the pail-system had worked well when the number of pails had not exceeded 30,000, but now that the town had grown to a population of 240,000, and the pails increased to about 40,000, it had been found impracticable to continue to extend the system owing mainly to the difficulty of disposing of the contents of the pails. He was of opinion that water-carriage must be the system adopted in towns of over 20,000 inhabitants. He criticised the apparatus exhibited by Dr. Poore as likely to become fouled and not suitable for public service, and strongly favoured a system whereby the excreta is evacuated directly into the receptacles used for its removal.

Mr. Wm. White, F.S.A. (London), said we are told that the pail-system generally is being given up, but at Warrington, where some special application of the system had been in use for many years, the Corporation had at length found that they were able to make a good profit on the working of it. The water-carriage system was now considered perfect; but it had been perfecting for seventy years, and was very far from perfect yet, except in the absolute waste it entailed both of water and of productive profit; whilst air and water were polluted, and land was impoverished by it. He hoped that before another seventy years had passed, the dry system would be more fully perfected than this. He thought that the value of the solid portion of the excreta was greater than is generally allowed; and he instanced a farm where under very exceptional circumstances it had been used with great advantage on a wheat crop. Moule made a grand discovery in the use of earth, but he minimised its value, and he really retarded the application of his system, when he insisted that a mixture of ashes might be used with equal benefit, and that the earth might be dried by heat and used over again. [He even patented a stove for drying it.] Dr. Poore had pointed out that drying by heat sterilised the earth and destroyed or delayed its useful effect.

Dr. Shuttleworth (Richmond Hill) referred to his experience in connection with the Royal Albert Asylum for imbecile children at Lancaster, of which he had charge for many years, and where dry earth for the treatment of excrement had been used with considerable success. The two ranges of closets had simultaneous accommodation respectively for fifty boys and twenty-five girls (the population being 600), and they were very satisfactory as long as the necessary amount of dry earth could be obtained. In wet seasons there was a difficulty as to this, and then ash had been used as a substitute for dry earth, but the compost had not been so readily accepted by the farmer for manurial use. Latterly they had obtained excellent results by using the powder or dust from compressed peat litter, which could be readily obtained in the neighbourhood. In the first instance they had separate pails to the closets, but afterwards only an asphalted shallow pit, the earth being supplied thrice daily by a man passing along the gangway behind the seats with a barrow, and the whole contents removed once a week. He referred to Mr. Richardson's

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experience in the subject at Clifton, Bristol, from whom he had heard that one of the directors of the Dry Earth Company there placed so much faith in the odourlessness of the system that he actually had the apparatus fitted up in his dining-room!

Dr. Permet (London) said that in a small garden in Hampstead he had planted all kinds of things without success, but after having read Dr. Poore's pamphlet on "The Living Earth," he had adopted his suggestion of applying household sewage to the garden with good result, although the experiment was carried out in an intermittent manner.

Dr. Legge (London) said that he had recently had an opportunity of studying the sanitary arrangements of three large towns in the North of Europe—Christiania, Stockholm, and Copenhagen—where pails and cesspits were in use. The separation of excreta had been attempted, but was found to be productive of intolerable nuisance. In two of the towns the contents of the pails and cesspits were removed by contract and the result was not satisfactory. In Stockholm, however, the town takes all the responsibility, and the refuse is carried ten miles away from the town and disposed of on land. The death-rate in all three towns is low, varying from 19·3 per 1,000 in Christiania to 20·8 in Stockholm. In Christiania in 1892 only six deaths were attributed to typhoid fever, while in Copenhagen in the same year the death-rate from this cause was only 0·07 per 1000, and in Stockholm 0·18.

Mr. R. Williams (Lee, Kent) said that he was carrying out a number of buildings in Wales, and described the plan he was adopting with regard to earth-closets. He had often heard that ashes were good for use in earth-closets, but he had learnt—and the paper confirmed this—that they had not the deodorising properties of dry earth.

Dr. Edward Seaton (London) said that the thanks of sanitarians were due to Dr. Poore for so forcibly calling attention to a subject which still constituted one of the main difficulties in Public Health administration. The water-carriage system had been referred to as the "popular system." He, however, questioned the correctness of so describing it in some communities, as for example in Nottingham, where, as was well known, artizans would themselves carry pails full of excreta to their rose gardens on the Mapperley Hills. There at any rate the term "popular" might be suitably applied to the system which Dr. Poore so eloquently advocated. Nevertheless it must be taken as an accepted fact that in the case of towns the water-carriage system was for one reason or another to be regarded as the most practicable system of the future. Authorities generally agreed about that. It was, however, an entirely different matter when they came to consider the sanitation of villages, and the clusters of houses of which they were generally composed. He regretted that the time for

discussion that evening was too short to enable him to enter into this very important subject, which was of great and immediate interest from the official, parochial, and local government points of view. Dr. Poore, in his paper and in his writings, spoke rather to individuals than to communities. But even from that point of view, he (Dr. Seaton), thought the author failed to appreciate the great difficulties that there was in disposing of slop-water, under existing conditions in village communities, in such a way as to avoid river pollution, and to prevent the occurrence of "Nuisances injurious or dangerous to Health."

Dr. S. K. Nariman (London), referred to his sanitary experience in India, which was quite in accord with Dr. Poore's, as regards the disposal of the solid excreta, but he was opposed to dry methods of sanitation, on account of the great difficulty in dealing with urine and waste water. In India, wherever the latter were allowed to soak into the ground, they spread malaria and gave rise to mosquito pests. As an instance, at the Bombay Veterinary College the excreta, etc., of about 100 people and 100 animals were dealt with by the dry methods, in an open space of 25,000 square yards, round about the college buildings, the space being utilised as a garden for growing flowers, fruits and vegetables. As the urine and slop-water all had to percolate into the ground, two years after the college was occupied the place became highly malarious, the effects of the malaria being more marked in the rainy season, and just after it (August, September and October), when the moisture begins to evaporate from the ground. As usual, the Europeans suffered more heavily than Indians with dysentery, hepatic, abscess, and neuralgic pains. Before the committee appointed to enquire into the sanitation of the place, he strongly urged the necessity of collecting urine and slop-water in cesspools, with a view to carting them away daily to throw into a main-sewer or into the sea. This plan has since been adopted, and the place is now almost free from malaria. He also instanced the case of a newly-built bungalow, where the same results followed a year or two after occupation. The wells on examination were, in each case, found to be uncontaminated.

Mr. G. Murray (London) referred to the various moulds and fungi peculiar to excreta, giving the result of a superficial census of them he had made. He argued from this and other facts that large numbers of moulds were specifically present in the excreta of particular animals and ready to germinate soon after emission, and showed that in this method of sanitation man is only following nature's plan. He regarded Dr. Poore's exposition as a great victory of principle, and expressed confidence in the future perfecting of methods of adapting it to the conditions of country and suburban life.

Dr. S. Rideal (London) referred to the fact that the alkaline salts of the fatty acids (soaps) were prejudicial to the growth of the

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nitrifying organisms, and this would be fatal to any arrangement for applying slop-water continuously to the same land. In Dr. Poore's experiment he had collected from several cottages the valuable waste products (urine and solid fæces) and left on the land of those cottages the slop-water to be got rid of by some other system.

Sir Thomas Crawford, K.C.B. (Chairman), said that in India the dry method was applied to all cantonments of troops; but there was difficulty in applying it to the villages, as the natives resent any interference. In the large towns—Bombay, Calcutta, and Madras, the sanitary arrangements were more advanced. He thought that Dr. Poore was right as to the desirability of shallow trenches for burying excreta; but as it was easier to dig one deep trench than several shallow ones, the coolies had to be well looked after. The rule in the cantonments was that these trenches should not be more than 10 or 12 inches deep, and filled in every day. The excreta was carried from the barracks in air-tight vessels on carts to the trenches, which, of course, should be lower down the watershed than the wells. He had found no cantonment in India where the troops had been free from enteric fever. The young soldiers were mostly attacked, and he thought there might be some truth in a recent suggestion, that it might be due to the filters at railway stations, which were not always supplied with filtering material of unexceptionable purity. As chairman he proposed a hearty vote of thanks to Dr. Poore for his investigations and for going so thoroughly into the matter in the present paper. He thought that Mr. Sillar had not said too much on the subject of the waste of sewage.

Dr. G. V. Poore (London) in replying, said, that his lecture was mostly on the question of principle, and a great deal more might be said on the details of adaptation of the principle to particular cases. He could not agree with all that Mr. Sillar has said, because, when you mix water with sewage the great trouble of dealing with it commences. The success of the dry system depends very much upon management; no doubt peat is applicable to the system, but like sawdust it contains a certain amount of antiseptic, and the compost takes a longer time to ripen as a manure. Peat even when sterile destroys germs. The sawdust urinal he had referred to was working satisfactorily, at the railway works at Twickenham, and the engineer would be glad to give any member of the Institute facilities for seeing it. With regard to the detail of arrangement, he thought that a trowel and bin of earth was very much better than any mechanical arrangement. One drawback to earth-closets is, that they may go for weeks without being used, and the earth gets too dry and dusty. In his own experience the slop water and urine from a very small establishment (never more than five persons) had been run for seven years at the foot of a privet hedge, with a flower bed in front, without causing nuisance. Of course, if you do not take crops from manured land it will not take so much sewage.

ON BACK-TO-BACK HOUSES.

By JAMES NIVEN, M.A., M.B., Medical Officer of Health, Manchester.

With Illustrations of various types of Back-to-Back Houses met with in Practice, and the methods adopted for dealing with this class of property, by

T. DE COURCY MEADE, M.INST.C.E., City Surveyor, Manchester.

Read at Sessional Meeting, March 13th, 1895.

THE objects of this paper are:—1. To discuss the influence of back-to-back houses on health, and—2, To explain what action the Manchester Corporation is taking to remedy the defects of these dwellings. The most important investigations on the effects of these houses on health are probably contained in the contribution of Dr. Tatham to the Report by Dr. Barry and Mr. P. Gordon Smith on this subject, and in a paper by Mr. Herbert Jones, Medical Officer of Health for Crewe, in *Public Health*, August, 1893. Dr. Tatham endeavoured to elucidate the question by comparing the death-rates from all causes, from infectious diseases, from phthisis, and from lung diseases, in the Registration sub-districts of Greengate and Regent Road in Salford.

The registration sub-districts are classified according to the proportion of back-to-back houses in them, and the figures are totalled in groups as shown in the table on the opposite page.

These are most striking figures, which make it highly probable that the mere fact of being back-to-back renders a house injurious to its inmates. But, however valuable the results obtained may be, they fall short of proof and are open to these objections.

In the first place the back-to-back houses, certainly, on the whole, lie in the older and less sanitary parts of Salford, so that, in the total of districts containing no back-to-back houses, there are many that are probably much healthier than any of those containing back-to-back houses, and these will doubtless lower the total death-rates.

In the second place, when we examine in detail the tables

Table showing the Mortality Statistics from all and certain Specified Causes during the five years 1879–83, in groups of Districts containing different proportions of back-to-back houses comprised within the Greengate and Regent Road Registration sub-districts of Salford.

District.	Population.	All Causes		Pulmonary Diseases other than Phthisis.		Phthisis.		Small-pox, Measles, Scarlatina, Diphtheria, Whooping Cough, Fever, Diarrhœa.		Deaths from Diseases enumerated in Columns 3–5.		Deaths from Diseases not enumerated in Columns 3–5.		Diarrhœa.	
		Deaths Registered.	Death-rate per 1,000 living.	Deaths Registered.	Death-rate per 1,000 living.	Deaths Registered.	Death-rate per 1,000 living.	Deaths Registered.	Death-rate per 1,000 living.	Deaths Registered.	Death-rate per 1,000 living.	Deaths Registered.	Death-rate per 1,000 living.	Deaths Registered.	Death-rate per 1,000 living.
	1	2		3		4		5		6		7		8	
Greengate—															
Group I.—9 Districts containing no back-to-back houses	8,713	1,199	27·5	289	6·6	123	2·8	198	4·5	610	13·9	589	13·6	62	1·42
" II.—13 Districts containing an average proportion of 23 per cent. of back-to-back houses	11,749	1,719	29·2	457	7·8	195	3·3	282	4·8	934	15·9	785	13·3	91	1·55
" III.—12 Districts containing an average proportion of 56 per cent. of back-to-back houses	11,405	1,738	30·5	449	7·9	203	3·6	352	6·2	1,009	17·7	729	12·8	121	2·12
Greengate Sub-District	31,867	4,656	29·2	1,195	7·5	521	3·3	832	5·2	2,553	16·0	2,103	13·2	274	1·72
Regent Road-															
Group I.—72 Districts containing no back-to-back houses	54,264	7,079	26·1	1,560	5·7	725	2·7	1,330	4·9	3,615	13·3	3,464	12·8	418	1·54
" II.—10 Districts containing an average proportion of 18 per cent. of back-to-back houses	8,773	1,276	29·1	329	7·5	119	2·7	215	4·9	663	15·1	613	14·0	81	1·85
" III.—6 Districts containing an average proportion of 50 per cent. of back-to-back houses	4,380	817	37·3	189	8·6	99	4·5	167	7·6	455	20·7	362	16·6	62	2·83
Regent Road Sub-District	67,417	9,172	27·2	2,078	6·3	943	2·8	1,712	5·0	4,733	14·1	4,439	13·1	561	1·66

furnished by Dr. Tatham, and scrutinise the districts adjoining those containing back-to-back houses, we find that in these also the mortalities are very high, being frequently in excess of the mortalities in the districts containing back-to-back houses.

Nevertheless in the Greengate district Dr. Tatham considers that the back-to-back houses, except for their structural arrangement, are placed under better sanitary conditions on the whole than through houses, and that there is no great difference in the social condition of the people inhabiting the two classes of dwellings. The figures for this district have, therefore, considerable value.

The ideal method of estimating the effect of back-to-back houses on the death-rates would be, if possible, to take a number of back-to-back houses built in the same manner as a similar number of through houses of similar materials and of equal soundness of construction, inhabited by the same class of people, engaged in the same pursuits and of equal social position, and then to compare the fortunes of the inhabitants in the two groups.

Fortunately we possess such an investigation in Mr. Jones' admirable paper.

The results at which he arrives are similar to those previously obtained by Dr. Tatham.

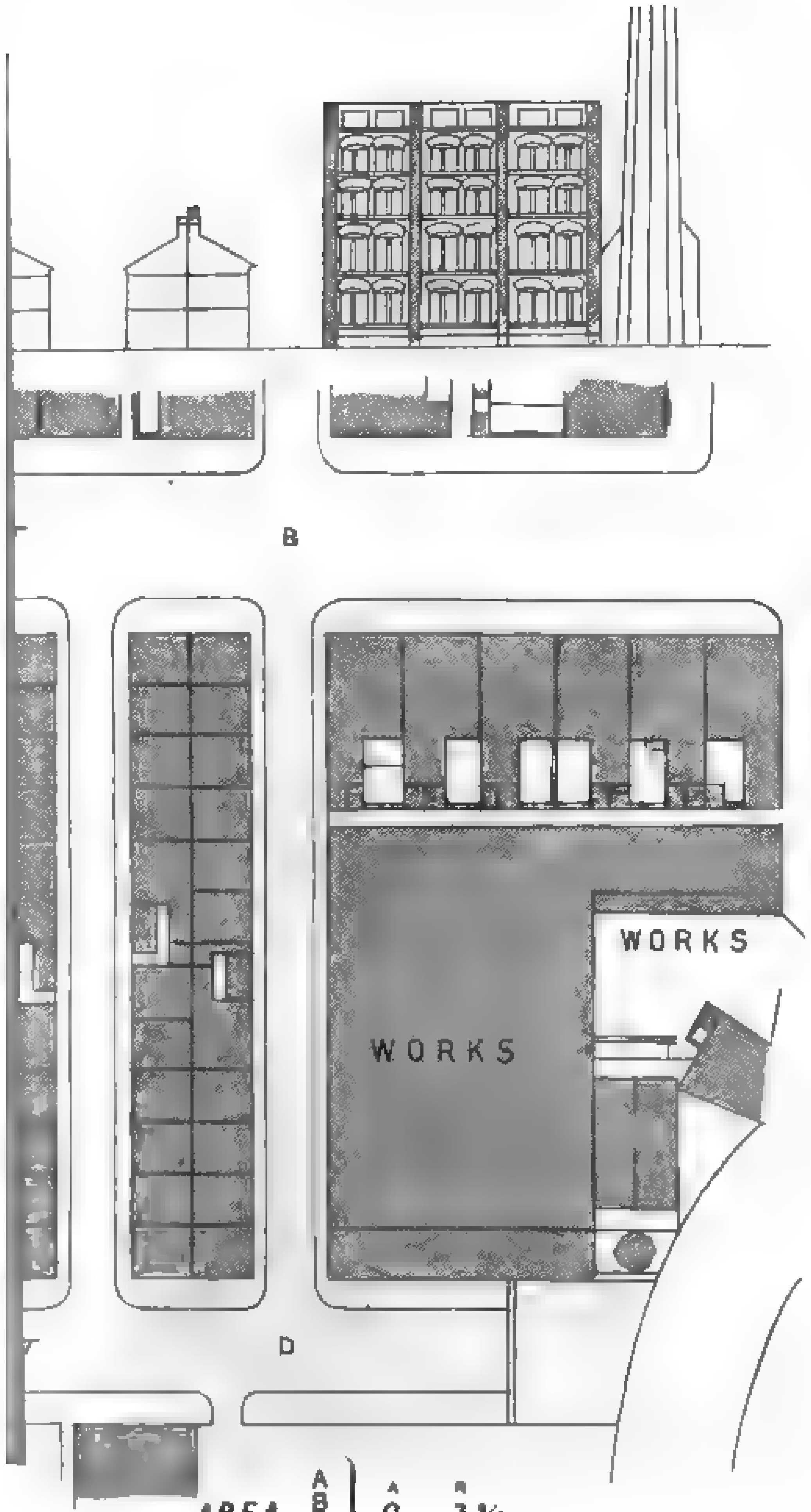
I would also mention an inquiry made by Dr. Pilkington of Preston, twenty years ago, which brought out a very excessive mortality in back-to-back houses.

Most medical men are agreed on this subject. But opinions must be able to stand the test of figures, and Dr. Bell, of Bradford, in a paper published in *Public Health*, February, 1892, has given figures which certainly appear to show that back-to-back houses of fair construction may be occupied without injury to health. The mode in which these houses were selected was criticised adversely by Dr. Evans, but there still wants something to explain the very low rates of mortality in them. The figures appear to suggest that in calculating these death-rates Dr. Bell omitted to distribute the deaths in public institutions of persons coming from these houses.

The investigation which I have made has reference only to Manchester. The back-to-back houses here are mainly in the older parts of the city. They are, many of them, dilapidated, with defective roofs, walls, floors, windows, and doors.

The condition of these dwellings is shown by Diagram 1, p. 256, giving a perspective view of the interior of two of these dwellings.

Then again, they are often contained in closed courts, when the privies, generally defective, are arranged in stacks in the



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T De Courcy Meade
City Surveyor,
Manchester

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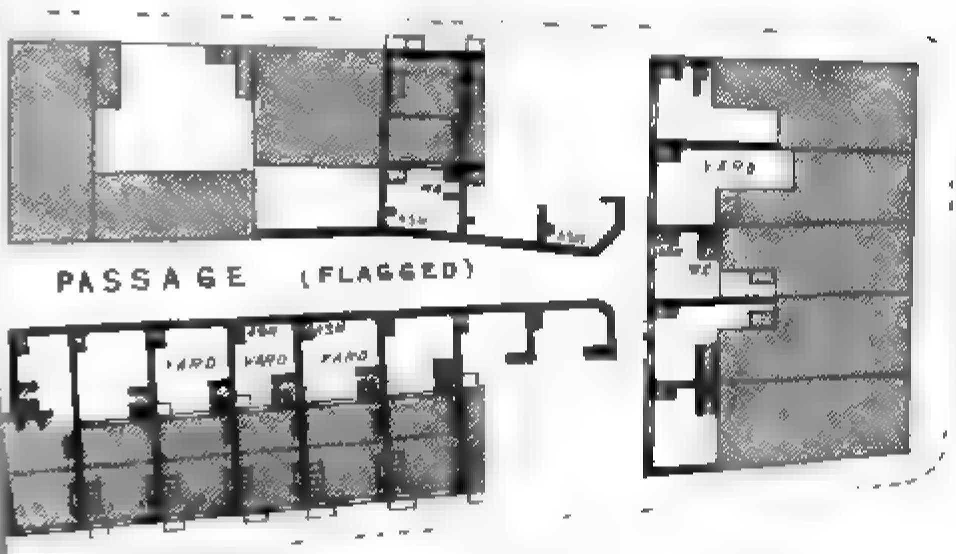

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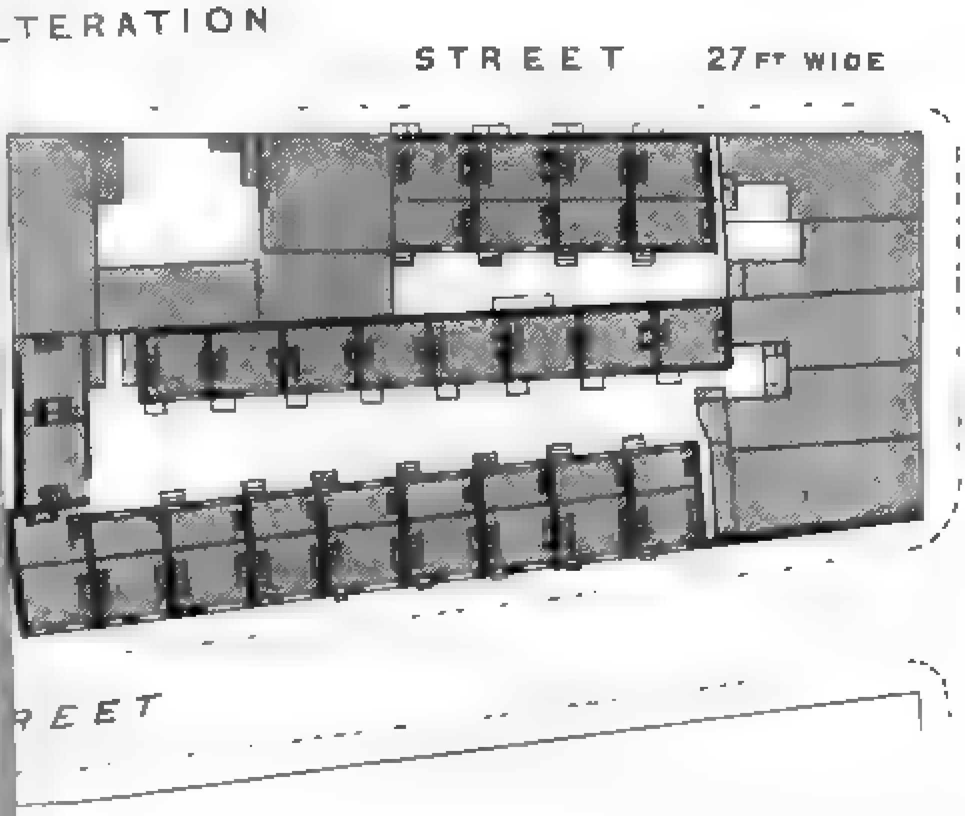

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interior of the court, or they are in narrow and confined streets and overshadowed, perhaps, by lofty buildings, with pail closets underneath bedrooms. A view of some of these conditions is given in Diagram 2, p. 256.

With the proviso, then, that this inquiry does not relate to back-to-back houses in the abstract, but to these dwellings as they occur in Manchester, I go on to describe the mode of inquiry pursued.

The old township of Manchester alone is dealt with. A census was, in the beginning of the present year, taken in each of the Inspectors districts in this area of the inhabitants in the back-to-back houses. This proceeding was rendered necessary by the operations of the Sanitary Committee which have considerably altered the number of back-to-back houses since 1891.

It was assumed that the population of these houses had not much altered since the census. Certainly it will not have diminished.

A description was obtained of the districts, and the total area was divided up into portions corresponding to this description, the object being to select portions of the districts in which the inhabitants of back-to-back houses were similar to those inhabiting other houses in their social conditions, pursuits, character and circumstances generally.

The population of each sub-district was calculated on the basis of the censuses of 1881 and 1891 to the middle of the period 1891-94. A slight error will occur in the population of the districts, if the diminution of population has been at a different rate in these years, but such error will certainly not be large.

The death-rates for the sub-districts were then calculated out from different causes, and at groups of ages, as shown in the following tables, summarised from the separate tables for each sub-district.

Tables 3 and 4 refer only to the selected districts.

The figures marked "difference" are figures which I have elsewhere called poverty indices. They show the death-rates on the actual population due to deaths which have occurred in public institutions, mostly in the Union.

It will be seen that in these selected districts there is, as far as these figures are concerned, rather more poverty in the other houses than in the back-to-back houses.

Table 5 sums up the figures for the selected districts, by the addition of their populations and deaths and a fresh calculation of the death-rates.

TABLE I.—*Death-rates in † selected Districts in the Township of Manchester in 1891-94 in all Houses and in Back-to-Back Houses respectively.*

District.	All Houses.				Back-to-back Houses.			
	Population.	Death-rates after Distribution.	Death-rates without Distribution.	Difference.	Population.	Death-rates after Distribution.	Death-rates without Distribution.	Difference.
7*a*	5952	33·4	26·6	6·8	961	39·3	33·0	6·3
9*a*	8617	36·3	24·6	11·7	1418	44·1	35·9	8·2
10	14,214	34·5	26·7	7·8	1894	46·3	38·0	8·3
11*a*	10,919	28·5	23·3	5·2	2267	34·7	30·2	4·5
1*a*	4722	18·2	14·2	4·0	506	20·8	18·8	2·0
9*b*	8689	30·4	24·9	5·5	773	36·9	32·7	4·2
3	13,534	28·5	21·5	7·0	1371	28·6	24·4	4·2
6*c*	7769	27·3	23·9	3·4	387	29·1	27·2	1·9
8*a*	817	24·8	19·3	5·5	147	25·5	22·1	3·4

† These Districts were selected entirely from the statement of the character of the Districts, with one exception, viz.: 7*b*, which was relegated to the following Table on account of the large poverty index for back-to-back houses.

Table II.—*Death-rates in unselected Districts in the Township of Manchester, 1891-94, in all Houses and in Back-to-Back Houses respectively.*

District.	All Houses.				Back-to-back Houses.			
	Population.	Death-rates after Distribution.	Death-rates without Distribution.	Difference.	Population.	Death-rates after Distribution.	Death-rates without Distribution.	Difference.
1*b*	5457	24·0	15·3	8·7	397	29·0	20·2	8·8
* 2*a*	13,197	33·5	22·3	11·2	1528	31·6	27·3	4·3
2*b*	549	17·8	14·1	3·7	127	15·8	11·8	4·0
6*a* * (Angel Meadow)	2159	49·7	17·1	32·6	354	32·5	26·2	6·3
6*b* * (Angel Meadow)	7496	40·8	22·9	17·9	2208	38·5	28·0	10·5
7*b*	12,061	22·4	20·2	2·2	555	26·1	20·3	5·8
8*b*	25,148	24·3	22·1	2·2	120	20·8	16·7	4·1
11*b*	3202	23·3	21·8	1·5	5	50·0	50·0	—

* Contain a large lodging-house element (see column of differences).

TABLE III.—*Populations in selected Districts in all Houses and in Back-to-Back Houses at Groups of Ages.*

District.	Under 1 Year.		Ages 1 to 5.		Ages 5 to 15.		Ages 15 to 25.		Ages 25 to 45.		Ages 45 to 65.		65 and upwards.	
	All Houses.	Back to Back.	All Houses.	Back to Back.	All Houses.	Back to Back.	All Houses	Back to Back.	All Houses.	Back to Back.	All Houses.	Back to Back.	All Houses.	Back to Back.
7a	169	30	602	113	1328	211	1147	142	1751	317	816	131	139	17
9a	267	56	873	172	1975	279	1738	233	2380	462	1187	203	197	13
10	442	73	1441	227	3259	410	2868	307	3919	601	1960	232	325	44
11a	339	95	1107	300	2504	426	2203	378	3011	745	1506	279	249	46
1a	110	17	393	74	946	141	978	76	1441	129	729	58	125	11
3	316	51	1127	172	2712	286	2803	223	4130	407	2090	200	356	32
6c	220	14	786	51	1733	75	1497	56	2286	135	1065	45	182	11
8a	23	7	83	19	182	28	158	18	240	54	112	15	19	6
9b	270	30	880	94	1992	152	1753	115	2396	288	1199	84	199	10

Table IV.—*Death-rates from all Causes at Groups of Ages in selected Districts in 1891-94.*

District.	Under 1 Year.		Ages 1 to 5.		Ages 5 to 15.		Ages 15 to 25.		Ages 25 to 45.		Ages 45 to 65.		65 and upwards.	
	All Houses.	Back to Back.	All Houses.	Back to Back.	All Houses.	Back to Back.	All Houses.	Back to Back.	All Houses.	Back to Back.	All Houses.	Back to Back.	All Houses.	Back to Back.
7a	331·1	375·0	64·3	75·2	5·6	5·9	6·5	8·8	18·1	23·1	46·6	47·7	136·7	133·3
9a	259·4	294·8	67·9	78·5	6·7	12·6	6·6	14·0	20·8	18·4	64·4	56·7	172·2	442·3
10	279·5	359·5	62·8	87·1	7·2	6·7	7·6	5·7	18·3	21·6	54·6	73·3	160·0	164·8
11a	272·9	264·1	49·2	57·5	6·4	8·2	6·1	7·3	13·8	12·4	39·5	44·6	136·6	141·3
1a	213·5	205·7	40·7	47·3	3·4	1·8	3·3	0·0	7·6	7·8	24·0	36·8	90·0	0·0
3	338·0	269·6	53·2	36·3	5·8	2·6	5·0	3·4	14·8	13·5	40·7	33·8	122·2	171·9
6c	236·5	285·5	38·2	44·1	6·1	13·3	6·5	4·5	16·6	9·3	44·8	33·3	131·8	90·9
8a	130·4	71·4	42·2	52·6	4·1	17·9	4·7	0·0	14·6	9·3	55·8	16·7	131·4	166·7
9b	278·8	300·0	61·1	63·8	4·0	6·6	6·8	10·9	14·6	13·0	42·5	47·6	146·8	350·0

TABLE V.—*Death-rates in Age Groups 1891–94. Districts 7a, 9a, 10, 11a, 1a, 9b, 3, 6c, 8a.*

Causes of Death.	All Ages				Under 1 Year				1—				5—				15—				25—				45—				65—			
	All houses.		Back-to-Back.		All houses.		Back-to-Back.		All houses.		Back-to-Back.		All houses.		Back-to-Back.		All houses.		Back-to-Back.		All houses.		Back-to-Back.		All houses.		Back-to-Back.		All houses.		Back-to-Back.	
	Rate.	Rate without Workhouse.	Rate.	Rate without Workhouse.	Rate.	Rate without Workhouse.	Rate.	Rate without Workhouse.	Rate.	Rate without Workhouse.	Rate.	Rate without Workhouse.	Rate.	Rate without Workhouse.	Rate.	Rate without Workhouse.	Rate.	Rate without Workhouse.	Rate.	Rate without Workhouse.	Rate.	Rate without Workhouse.	Rate.	Rate without Workhouse.	Rate.	Rate without Workhouse.	Rate.	Rate without Workhouse.	Rate.	Rate without Workhouse.	Rate.	Rate without Workhouse.
All Causes ...	30·3	23·7	27·0	21·4	279·1	245·0	299·7	286·3	55·7	48·2	63·6	60·3	5·9	5·3	7·2	7·1	6·2	5·1	7·2	5·7	15·9	11·4	15·9	12·0	45·8	31·8	49·7	36·9	139·1	83·4	173·4	96·1
Phthisis	2·7	...	3·0	...	0·2	...	...	...	0·5	...	0·2	...	0·7	...	0·6	...	2·1	...	2·6	...	4·6	...	4·9	...	5·0	...	6·4	...	1·8	...	1·3	...
Lung Disease	8·2	...	9·7	...	60·2	...	60·4	...	17·7	...	20·4	...	1·3	...	1·6	...	0·9	...	0·6	...	3·3	...	3·9	...	15·5	...	17·8	...	45·6	...	50·2	...
Small-pox ...	0·0	...	...	...	0·1	...	...	...	0·0	...	...	...	0·0	...	...	...	0·0	...	—	...	0·1	...	...	...	0·0	...	...	...	...	...	...	...
Measles	0·8	...	1·4	...	6·3	...	6·7	...	5·8	...	8·8	...	0·1	...	...	...	0·0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Scarlet Fever	0·3	...	0·3	...	0·3	...	...	.	1·8	...	2·0	...	0·3	...	...	...	0·0	...	...	...	0·0	...	...	...	...	...	...	...	...	...	...	...
Diphtheria ...	0·2	...	0·3	...	0·7	...	1·3	...	1·7	...	1·6	...	0·2	...	0·1	...	0·1	...	...	...	0·0	...	0·1	...	...	...	...	...	...	...	...	...
Whooping C.	0·9	...	1·1	...	10·4	...	12·1	...	5·3	..	4·7	...	0·2	...	0·2	...	0·0	...	...	...	...	..	...	...	...	...	...	...	...	...	...	...
Enteric Fever	0·3	...	0·3	...	0·2	..	...	...	0·2	...	...	...	0·3	...	0·4	...	0·4	...	0·6	...	0·2	...	0·4	...	0·3		...	...	...	...	...	...
Typhus Fever	0·0	...	...	...	...	...	...	...	...	...	...	...	..	...	...	...	0·0	...	...	...	...	...	...	...	0·0	...	...	...	...	...	...	...
Ill-def Fever.	0·0	...	...	...	0·1	...	...	..	...	...	...	...	0·0	...	...	...	0·0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Diarrhœa......	1·6	...	2·6	...	33·6	...	36·2	..	4·3	...	9·0	...	0·1	...	0·1	...	0·0	...	...	...	0·0	...	0·1	...	0·4	...	0·4	...	2·6	...	1·2	...
Total Zymots.	4·0	...	6·0	...	51·7	...	56·3	...	19·7	...	26·2	...	1·2	...	0·9	...	0·5	...	0·6	...	0·4	...	0·6	...	0·8	...	0·4	...	2·6	...	1·3	...
Other Dis. ...	15·4	...	18·3	...	167·0	...	183·0	...	17·8	...	17·0	.	3·5	...	4·1	...	2·8	...	3·2	...	7·6	...	7·5	...	24·7	...	25·0	...	53·2	...	110·6	...
Population .	75,233		9,720		2,156		573		7,292		1,272		10,631		2,008		15,145		1,548		21,554		3,128		10,664		1,347		1,791		190	

[redacted]

The general result of this calculation is seen to be in accord with Dr. Tatham's figures, although I think there is a decided advantage in the method pursued.

It will be seen that in infancy and in advanced years there is an excess of mortality in back-to-back houses which is not found in the middle period of life.

There is also a decided excess in lung diseases other than phthisis, and in zymotic diseases. There is also an excess in the death-rate from phthisis, though not so marked.

I now come to the second part of this paper, viz., a statement of the proceedings which have been adopted in reference to back to back houses in the City of Manchester. In Dr. Tatham's recent report on the health of Manchester for 1891-93, is given a map showing, by shading, the mortalities in districts in the years 1888-90, and a very large surface indeed is covered by black, indicating a death-rate of over 40 per 1,000. The excessive mortality in these districts has long been known, and in 1885 the Unhealthy Dwellings Committee was formed to deal with the conditions which were considered to give rise to it. Dr. Tatham's investigations published in Dr. Barry and Mr. Gordon Smith's Report in 1888, pointed very strongly to the influence of back-to-back houses in producing these high death-rates, and, undoubtedly, largely determined the subsequent policy in Manchester, which has been, as far as possible, to deal first with this class of property; a policy in which I decidedly concur.

Insanitary houses are dealt with in Manchester under the Local Act of 1867, section 41, which reads as follows:—

In any case where it is certified to the Corporation by an Inspector of Nuisances, or by any two medical practitioners, that any building or part of a building is unfit for human habitation, the Corporation may by their order, affixed conspicuously on such building, declare that the same is not fit for human habitation, and shall not, after a date therein to be specified, be inhabited; and any person who shall, after the date or time mentioned in such order, let or occupy, or continue to let or occupy, or knowingly suffer to be occupied, such building or part of a building, shall be liable to a penalty not exceeding five pounds, and for a continuing offence not exceeding forty shillings for every day during which the offence may continue: provided always, that if at any time after such order the Corporation shall be satisfied that such house has become or been rendered fit for human habitation they may revoke their said order, and the same shall thenceforward cease to operate.

It will be observed that in this Act the Sanitary Inspector

takes the place of the Medical Officer of Health, a circumstance which was due to there having been no Medical Officer of Health when the Act was passed.

In the year 1887 the policy was inaugurated of pulling down some of the houses in back-to-back blocks to make yards for the remainder, which were then made into through houses opening at the back into these yards. It was not, however until 1892 that these operations assumed very large proportions. In 1894 they have been considerably extended. In 1890 Dr. Tatham presented to the Sanitary Committee a report dealing with this process of conversion of back-to-back houses, which was re-issued in 1893. In this report are stated very clearly the limitations, under which he was prepared to approve of such alterations, as follows:—

"Without presuming to dogmatise on this difficult question, which, after all, is not exclusively a medical one, the Medical Officer of Health would ask the attention of the Committee to the following considerations:—

"1. It is generally admitted that back-to-back houses are bad in principle; the chief grounds for this statement are set forth in the last para. on page 1 (ante).

"2. Most of the houses of this construction in Manchester are very old; they are overcrowded on site, dilapidated, and ill-drained. Resting, as they do for the most part, on the bare ground, the floors are cold and damp. Where they do not open into back yards, they abut on narrow streets, which are frequently *culs de sac*. They are of necessity unventilated and are without decent closet accomodation.

"6. Inasmuch as the reconstruction or the renovation of houses on any really satisfactory plan will entail a heavy outlay on the owners, it becomes a serious question whether the Corporation is justified in conferring, so to speak, "a new lease of life" on property which is practically worn out, and which on this account is incapable of restoration to a condition fairly compatible with health.

"4. Wherever attempts have been made—in Manchester or elsewhere—to deal with worn-out or ill-constructed back-to-back property otherwise than by demolition, the results, judged from a sanitary point of view, are not satisfactory.

"5. It is a significant fact, to which attention has been directed in the report of Dr. Barry and Mr. Gordon Smith, that in the manufacturing districts of Lancashire, in the Potteries, and in the Black Country,

[redacted]

where dwellings of the back-to-back class had formerly prevailed to a very considerable extent, the system of building houses unprovided with means for through ventilation has been almost entirely discontinued. In the Yorkshire borough of Todmorden, where back-to-back house construction was at one time the rule, the erection of further buildings of this type is prohibited by local bye-law.

"Although the Corporation will probably hesitate to peremptorily require the demolition of all the back-to-back property in the city at an early date, it nevertheless appears to the Medical Officer of Health desirable that the further use of such buildings for human habitation should be restricted to those cases in which they can be brought into conformity with suitable conditions. On this point unfortunately no experience from other towns is available for our guidance; but it would seem expedient that the Corporation should lay down at least two fundamental requirements, in default of which the future occupation of such dwellings should be prohibited. These requirements should be—

"(*a*) That the principal materials of which the houses are constructed should be sound, and be capable of thorough repair according to one or other of the plans appended to this report.

"(*b*) That in every case the streets on both sides of the rows of cottages should be through streets without obstruction at either end; and that they should measure eight yards in width, at the least."

Concurrently with the alteration of houses in the above manner, several areas were condemned entirely under the Housing of the Working Classes Act, in the years 1889-91, and on two of these blocks Artizans' Dwellings have been erected in the style so well known in London. One of these blocks is intended to house 1,250 persons, the other to house 450 persons.

This is, indeed, the only proceeding possible, where it is desired to erect dwellings to take a population equal to that which has been displaced in crowded districts, if at the same time we are to secure a sufficient supply of fresh air and light.

It has been objected to these dwellings that the children are necessarily thrown together much more intimately than where the houses are quite separate opening on a street, and that infectious disease spreads more certainly in them merely from the aggregation of infection. Possibly it may be so to some extent, but not I think to such an extent as to form a serious argument against them.

I do not, in fact, know of any drawback attaching to these

dwellings, which does not also attach to cottages; and, if well contrived, soundly constructed, well ventilated, and properly drained, they should be an enormous advance. I consider such a building as has been erected off Oldham Road, in Manchester, with its large internal square, as a useful addition to the housing of the people.

But these buildings in successive storeys are not in favour in Lancashire. They are popularly known as barracks, and landlord and tenant combine to assail them. I can scarcely believe but that, if sufficient accommodation is provided for the tenants, they will ultimately become popular. To secure this end, however, they do undoubtedly require to offer very substantial advantages over separate houses.

It is, I think, absolutely essential to exercise a strict control, and to insist on having satisfactory tenants in the tenements.

To return to the methods of dealing with back-to-back houses. I have said that I concurred in the policy which had been pursued, viz., absolutely to condemn those back-to-back houses which do not fulfil the conditions laid down by Dr. Tatham, and in the remainder to insist on the making of yards for the houses with proper provision of conveniences. The magnitude of this task may be inferred from the following statement of back-to-back houses, presented by the Superintendent of the Sanitary Department in 1891. From this it will be at once seen in what a large proportion of these houses the living rooms must be plunged in darkness, and how large a number do not fulfil the condition of having a street 24 feet in width in front of them.

Statement of Back-to-Back Houses in the City, in accordance with the Resolution of the Unhealthy Dwellings Sub-Committee of November 18th, 1890.

Total number of back-to-back houses 9,240

Number of two-storey back-to-back houses opening into streets, courts, or passages of the following widths:—

From 1	to 2	yards	105	
„ 2	3	„	428	One of this number is
„ 3	4	„	634	[one storey high only
„ 4	5	„	981	One of this number is
„ 5	6	„	1351	[one storey high only
„ 6	7	„	964	
„ 7	8	„	954	Five of this number are
„ 8	9	„	418	[one storey high only
„ 9	10	„	618	Eleven of this number are
„ 10	11	„	251	[one storey high only
„ 11	12	„	554	
„ 12	13	„	132	
„ 13	14	„	132	
„ 14	30	„	360	

[redacted]

Number of three-storey back-to-back houses opening into streets, courts, or passages of the following widths:

From 1 to 2 yards	14	
" 2 3 "	80	
" 3 4 "	128	
" 4 5 "	147	Ten of this number are [four storeys high
" 5 6 "	176	
" 6 7 "	135	
" 7 8 "	64	
" 8 9 "	46	
" 9 10 "	89	Four of this number are [four storeys high
" 10 11 "	20	
" 11 12 "	99	
" 12 13 "	11	Four of this number are [four storeys high
" 13 14 "	23	
" 14 30 "	88	
Number of two-storey houses opening on to open spaces, &c.	174	Three of this number are [one storey high only
Number of three-storey houses opening on to open spaces, &c.	55	Fourteen of this number [are four storeys high
Number of houses where high buildings are near, and interfere with light and ventilation	370	
Number of houses at present unoccupied ...	513	

Total amount of rental per week	£1,470 3 8½
Average rental per week	0 3 2
Total number of occupants	31,008
Average number of occupants in each house...	3½

Attached to the Report of Dr. Tatham in 1893 are plans according to which alterations might be carried out in back-to-back houses.

These plans are marked A, B, C, D. The first three are exhibited in a diagram (p. 256) showing the dwellings converted into through houses.

Supposing in a double row of back-to-back houses, these are numbered 1, 3, 5, 7, &c., facing one way, and that those back-to-back with them are numbered 2, 4, 6, 8, &c., then plan A consists in taking out houses 3 and 4, which are replaced by yards. Into the yards replacing 3 and 4, each of which contains a water-closet and ash-box, an opening is made from the houses 1, 2, 5 and 6. Houses 9 and 10 are taken out and made into yards for houses 7, 8, 11 and 12, In this way the houses are made through and a free circulation of air takes place about every block of four.

Plan B consists in taking out numbers 3, 7, 11, &c. 1 and 2 are made into a double through house, which opens into the yard replacing 3, into which, also, opens No. 4; 5 and 6 are made into a double through house opening into the yard replacing No. 7, into which also opens No. 8 and so forth.

Plan C consists in removing houses 3 and 5, 11 and 13, and so on, replacing them by yards.

1 and 2 made double and through, and 4 open into the yard replacing 3, while 7 and 8 made into a through house, as well as 6, open into the yard replacing 5.

Plan D consists in shaving a portion off houses 2, 4, 6, 8, &c., and converting these portions into yards.

D is omitted, as it is not intended to alter more houses on this plan. Of those shown I should be disposed to admit A and C only, and C only where the houses have more than two storeys, in cases where a gain of light would be secured by adopting this plan. The circulation of air round the houses in plan A is so great an advantage as to give a clear preference to it. By any of these plans, A, B, and C, fair-sized yards are provided, common, it is true, to two houses. Water-closets are substituted for the pails formerly used, itself an enormous improvement. The ash-boxes are placed in a convenient position under cover. The drains are well-laid, and go directly into the street sewer.

So far as yards are concerned, these altered houses are in a much better position than many through houses, which are now provided at the back with extremely small air-spaces, the ground of which is, not rarely, soaked with urine.

It is the possibility of so much improving the air-spaces round the houses, and of removing from these dwellings conditions than which it would be difficult to imagine worse, which leads me to say that I heartily concur in the policy of first dealing with back-to-back property.

The difficulties are much more considerable when we come to deal with the defects of through houses.

All recent alterations have not been carried out strictly according to these three plans. Taking it as their aim to bring light and a free circulation of unpolluted air to the altered dwellings, the Corporation have been able in some instances to secure more substantial betterments, of one of which, made in 1894, I show a diagram (p. 256). In this case good yards and abundant air space have been furnished at the backs of the houses, and the back-to-back houses have been made through. In carrying out these alterations, it is intended in future to provide windows on the sides of the houses abutting on yards.

We are now in a position to consider what the Corporation have done in regard to these dwellings.

The following statement shows the total operations carried out by the Unhealthy Dwellings Committee since they were constituted in 1885.

[redacted]

Statement showing the number of houses (mostly back-to-back) certified as unfit for human habitation, and dealt with by the Unhealthy Dwellings Sub-Committee from February, 1885, to March 1st, 1895 :—

Total number of houses certified to, and dealt with by the Committee	4,485

Total number of houses actually added and made into double through houses with yards	817
Total number of houses actually demolished (exclusive of those in various areas)	440
Total number of houses actually repaired, and nearly all made into single through houses with yards	503
Total number of houses permanently closed	1,495
Actually treated	3,255

Leaving 1,230 which are accounted for below:—

Scheduled and dealt with in areas	225
Referred to and dealt with by other Committees ..	19
Awaiting expiration of notices to close	747
Stand adjourned	237
Orders of Committee not yet carried out	2
	1,230

The following return prepared by Mr. Rook, the Superintendent of the Sanitary Department, for Alderman Walton Smith, Chairman of the Sanitary Committee, of the alterations carried out in the worst districts of Manchester, shows clearly the rate at which these changes are going on.

Summary of Houses dealt with in the worst Districts of Manchester from January, 1889 to March 1st, 1895.

Year.	Number dealt with.	No. added, made into double through Houses and provided with Yards.	Number Demolished.	No. Repaired, and nearly all made into single through Houses, with Yards.
Jan. to Dec., 1889	152	9	13	12
Do. 1890	47	11	11	7
Do. 1891	109	31	13	17
Do. 1892	403	82	44	92
Do. 1893	373	69	52	104
Do. 1894	956	59	31	12
Totals - -	2,040	261	164	244
Jan. to Mar. 1895	260			
	2,300			

In addition to these, 239 houses have been demolished in the Oldham Road Area (on block 2) and Workmen's Dwellings built on the site, and 121 houses (on block 1) are now closed, and will be dealt with in a similar manner in due course.

105 houses have been demolished on the Pollard Street Area, and Workmen's Dwellings built on the site.

On the Pott Street Area, 58 houses have been purchased by the Corporation, a portion of which are now closed.

It will be seen from these figures that a considerable number of people must have been entirely displaced by these operations; not, it is true so many as at first sight appears, since at least one-third of the houses remain of those in which alterations have been carried out. What becomes of these people? No systematic inquiry has been made into the subsequent history of those who have had to leave the houses pulled down, but it has been ascertained that a portion of them do altogether leave the district, and go out into districts where building operations are going on. The greatest number, however, remain in parts not far removed from their old home, and there is thus, for a time, a tendency created to overcrowding in lodgings. This tendency, it is believed, is only temporary. A gradual pressure outwards is created. A wave, as it were, of outward movement permeates the community. It must be admitted, however, that the tendency to overcrowding requires to be very carefully watched over. This tendency, from the census which was taken in 1890 of back-to-back houses, and again in this year, does not seem to have materially affected back-to-back houses; and, indeed, the average number of persons living in these dwellings is lower than we should expect, though many of them contain large families. I have made inquiries as to any tendency which may have arisen in recent years to an increase in the number of new dwellings.

No increase, however, has occurred within the last three years, although there is reason to believe that on one side of the City just outside the boundary there has been an increase of building operations. Such, however, is the legitimate and even necessary outcome of these and other changes in the centre of Manchester, and we must be prepared to consider at no distant time, concurrently with a thinning of houses in the centre, the necessity of increased facilities for transit to and from the outer ring. In the meantime the present operations are calculated to effect a revolution in the habits and in the health of a considerable section of the poorest inhabitants of Manchester.

[redacted]

Sir Francis Powell, Bart., M.P. (London) said that he had been much interested in Dr. Niven's paper, and the illustrations prepared by Mr. de Courcy Meade. Every figure which he gave was full of instruction and interest. He was rejoiced to hear a condemnation of the odious system of back-to-back houses proved by such clear statements. When he was Chairman of the Police and Sanitary Committee of the House of Commons, that Committee did not allow these houses to be built; he believed that they were not allowed to be built in Preston, and the lecturer had told them that they were not allowed in Manchester—then why should they be allowed in Leeds? It was a disgrace to Parliament and a scandal to legislation that in an Act passed so recently as 1893, new back-to-back houses should have been permitted in Leeds; it was the more to be condemned because Leeds is a Borough in which large districts are semi-rural in character. As a Sanitarian who had been labouring for very many years in promoting Sanitary Legislation, he felt it his duty to condemn the policy of Parliament in the Leeds Act of 1893. The lecturer had pointed out several ways in which this class of property might be improved, but they ought not to allow any more of it to be built. The upper classes of society are acted upon by a centrifugal force which causes them to live away from the centres of towns, and he thought that this force would also act in time on the artizan class; and with the provision of cheap modes of transit, there will not be the same need for congestion in centres—but they will be able to live in the suburbs or the country, where they can have, if not a garden, at least a park. He asked those present to accord a hearty vote of thanks to the lecturer and also to Mr. de Courcy Meade.

Prof. W. H. Corfield (London) said that he was engaged many years ago in the investigation of a number of outbreaks of infectious diseases under the Medical Officer of the Privy Council, Sir John Simon, and he found that infectious diseases spread much more rapidly in back-to-back houses than in others. This had also been proved in Liverpool, especially with regard to typhus fever; these back-to-back houses had been condemned by Dr. Taylor, who was formerly Medical Officer of Health there, and pulled down at the rate of 500 a year, resulting in a reduced general death-rate, and a greatly reduced mortality from typhus fever. Sometimes in these houses the rooms on the second storey, and even on the first, had no flues, thus enhancing the difficulty of ventilation. In a paper which he had prepared at the request of the Executive Committee of the International Congress of Hygiene at Buda Pesth, he submitted a number of sanitary principles in the form of a resolution, and among these was one condemning back-to-back houses; this resolution, much to his astonishment, met with a great deal of opposition principally, so far as back-to-back houses were concerned, from the French delegates. It was afterwards pointed out to him that to carry out the resolution it would have been necessary to pull down half of Paris. Perhaps this plan of construc-

tion which is there in vogue may in part account for the higher death-rate of that city as compared with many other large towns.

Mr. T. DE COURCY MEADE (Manchester), referring to the plans adopted for the improvement of back-to-back houses in Manchester, said that where the re-modelling of this class of property was carried out to the satisfaction of the Corporation the owners were paid a sum of money towards clearing away certain buildings or portions of buildings, and paving the areas so formed. The sum paid would probably equal the cost of pulling down the buildings and paving the site. With regard to the position of the water-closets, it was found by experience that the severe frosts in Lancashire damaged the closet basins and waste-preventing cisterns when they were placed apart from the dwelling, therefore the closets were now placed next to an external wall, and the waste-preventing cistern was fixed inside the dwelling house and actuated by means of a lever and pull and chain. He would not like it to be thought that the plans now inspected were considered complete models of their kind: they might be regarded as a compromise with the owners. The property re-modelled according to these plans was no doubt greatly improved, but many of the areas so dealt with were from their characters and surroundings incapable of being treated in a satisfactory manner—in fact, in many cases, nothing short of total demolition would be effectual. He would add that as a rule the owners were found willing to meet the requirements of the Corporation in a reasonable spirit.

Mr. T. LOCKE WORTHINGTON (London) said that during the last few years there had been much discussion and condemnation of "Back-to-back Cottages," but very little had been said concerning "Back-to-back Superimposed Colony or Block Dwellings." All houses should be "through-ventilated," whereas some modern block dwellings were practically back-to-back cottages superimposed. Not long ago he had been commissioned to examine and report upon the dwellings of poorer citizens in the towns of France. He found that *some* of the most recent artizans' block dwellings in Paris, though substantially constructed, and having, for Continental buildings, unusually good sanitary arrangements, were practically back-to-back dwellings. Nearer home, in London, are to be found several high superimposed well-built artizans' dwellings, in which the *sine quâ non* of a healthy home, viz., proper "through ventilation," has been overlooked.

Mr. S. S. PLATT (Rochdale) was surprised to hear that the pail-system had been found so bad and defective in Manchester, they did not find it so in Rochdale; and he saw no reason for it if the apparatus was properly constructed. Some of the plans exhibited showed rooms built over the closets. Twenty-three years ago this arrangement had been condemned in Rochdale, and he wondered that it was allowed in Manchester. The plan for re-arranging back-to-back houses in which through ventilation was not provided was,

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he thought, objectionable; and he thought that a closet ought to be provided for each house—he did not like the closet placed adjoining the house. He would like to know whether the alterations made to the property in Manchester materially raised the rents and so drove away the population.

Dr. J. Niven (Manchester), in reply, said that he should object to an artizan dwelling in which the tenements became practically back-to-back dwellings. He did not think that there was any town in Lancashire where new back-to-back houses are now allowed to be built. A closet to each house, as suggested by Mr. Platt, would no doubt be desirable, but would take up room in the yard. The improved schemes had of course raised the rents, but had not made them prohibitive. The difficulties experienced from freezing of pipes, &c., were avoided both by the waste-water-closets and by having the cisterns of the water-closets inside the house. The small communication entailed by the latter arrangement between the house and the closet he did not regard as a serious matter.

COMBINED DRAINAGE,

FROM THE POINT OF VIEW OF HEALTH, CONSTRUCTION, ADMINISTRATION, AND LAW.

By J. F. J. Sykes, M.D., D.Sc., Medical Officer of Health, St. Pancras.

Read at the Sessional Meeting April 3rd, 1895.

Various public bodies and societies have of late had under consideration the vexed question of combined drainage; but they have by no means exhausted the subject, for it is very complex. The question is one that will require extensive discussion before any equitable conclusion can be arrived at, and the Sanitary Institute has very properly felt that as an institution where the professions concerned with disease causation and preventive medicine, and those engaged in constructive operations and civil engineering meet on common ground, it forms a fitting forum for the consideration of this immediately important question from all practical points of view.

The particular portion of the drainage and sewerage system of communities about which so many doubts have arisen is neither that portion which is definitely recognised and acknowledged as "sewers," constructed and maintained by public authorities, nor that portion undeniably admitted and known as "drains," constructed and maintained by private individuals, but it is that intermediate part or parts which unite the latter to the former under certain conditions; those conditions being that, on the one hand, they resemble sewers in carrying the drainage of more than one premises, and, on the other, resemble drains in that they generally lie within private premises in the greater part of their course, and have been originally constructed by, and at the expense of, private individuals, and not by public authorities. The question is further complicated by the "right of easement."

My friend Mr. Blair and myself are agreed upon all material points, and our opening will run upon parallel lines, but, as it is fitting and proper to the opening of such a discussion as this, influenced by the bearings of our respective professions. We do not propose to run to great length, but having put before you the leading points, we desire to leave time to elicit from you a discussion from all the points of view available.

In the present state of opinion it is necessary in the very *first place* to ask the all important question :—

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Can sewers and drains spread or cause disease? Recently, as you are aware, a very elaborate series of investigations into sewer air has been carried out upon the instruction of the Main Drainage Committee of the London County Council, by Mr. J. Parry Laws, at first alone, and subsequently, in conjunction with Dr. F. W. Andrewes, and three Reports have been issued upon the subject. In the first Report, Mr. Parry Laws, sums up by stating that "the whole of my results point unmistakably to the conclusion that the principal, if not the only source of micro-organisms in sewer air, is the air without the sewer and not the sewage, and they also tend to prove that there is very little ground for supposing that the micro-organisms of sewage, *in the absence of violent splashing*, become disseminated in the sewer air." The italics are those of Mr. Parry Laws, and in the body of the Report he further says, "it has been shown by previous experimenters, that if the splashing is sufficiently violent to produce a very fine state of division of the sewage, organisms will be carried some distance, even fifty to sixty yards." There do not appear to have been any investigations into the effects of either hot water, or steam discharged into sewers. In the second Report he states, "the results of these further investigations strengthen very considerably the conclusion arrived at from my previous experiments, viz., that the micro-organisms in the sewer air are related to the micro-organisms in the air outside, and not to the micro-organisms of the sewage." Further, "as I have stated in my previous report, the organisms of fresh air and sewer air consist chiefly of moulds and micrococci, whereas the organisms of sewage, so far as my limited observations go, consist essentially of moulds and bacilli." He also adds "although one is led almost irresistibly to the conclusion that the organisms found in sewer air probably do not constitute any source of danger, it is impossible to ignore the evidence, though it be only circumstantial, that sewer-air in some instances has had some casual relation to zymotic disease," and he suggests that this may be chemical rather than bacteriological.

In the third and conjoint Report these conclusions are again confirmed, and as the result of bacteriological experiment, "not a single colony of any of those species which we have found predominant in sewage has been isolated from sewer air," and Mr. Parry Laws and Dr. Andrewes suggest that it is possible that some of the ill-effects ascribed to sewer air may have been erroneously so ascribed, and may be due to subsoil air derived from soil polluted by constant infiltration of excremental matter through a leaky drain. The second part of this Report is devoted to typhoid fever in its relation to sewage, and the

vitality of the typhoid bacillus in sewage. The investigators failed to find the typhoid bacillus in ordinary sewage, and became oppressed by a sense of mathematical improbability. They recognised that the struggle for existence amongst the organisms in sewage, assisted by the fermentative and putrefactive changes in the nutrient medium, would result in the survival and multiplication of certain forms and the disappearance of others. They found by experiment that in ordinary sewage, typhoid organisms do not tend to survive, and "their death is probably only a matter of a few days, or at most, one or two weeks. But this degree of resistance may, nevertheless, be sufficient to allow of their being carried in sewage to remote distances and of their being able to produce disastrous results, should they gain access to any water-supply." But, although in the general sewers the probability is that the longer they remain and the further typhoid organisms travel the less their chance of survival, yet "in the drain from the typhoid block of a fever hospital, when the stools have not been disinfected for two days, a bacillus can be found which as far as demonstration can go is identical with that believed to be the actual cause of typhoid fever. So far as we are aware this important fact has never previously been demonstrated." I have quoted these Reports somewhat fully, because they are of immense importance, and while they go towards proving that typhoid organisms are, by the struggle for survival, killed off in *sewers*, and also do not appear in sewer air; yet they show that typhoid organisms do appear in the sewage of specifically infected *drains*, and that splashing will cause organisms to be carried considerable distances. What the effect of hot vapours, together with violent splashing, invariable conditions in house drains, may be in the presence of the typhoid bacillus it is not difficult to surmise, and tends to support the opinion of large numbers of medical officers of health and medical practitioners that typhoid may be spread ærially by defective drainage.

It is to be regretted that in the *Times* of 31st January, 1895, a leading member of the London County Council is *reported* to have said, in speaking of these Reports, at a meeting of the National Health Society, that "therefore typhoid fever could not be communicated by the air escaping from drains." Such a conclusion cannot be applied to *drains*, and it would be a serious matter if such an idea gained ground. If no specific organisms gain access to a defective house-drain, specific disease would scarcely be expected from that source; but if specific organisms do gain access, there is a possibility of specific disease being conveyed. Even in the absence of specific organisms the experiments of Dr. Alessi recorded in *Nature* of 3rd May,

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1894, distinctly prove that the effect of breathing sewer-gas is to lower the vitality and strongly predispose to fatal typhoid infection, and also to the fatal attack of the *Bacillus coli communis*—a bacillus somewhat resembling the typhoid bacillus. These experiments were numerous and complete, and the results have not been controverted.

It is beyond dispute that public-water supplies and private wells, becoming polluted by specifically infected and leaky drains, will spread certain diseases either directly by means of the water, or indirectly by polluting food or vessels washed with the water, but it is disputed that specifically infected drains can ærially convey specific infection, although it is generally admitted that drain-air is injurious and lowers the vitality, and by most is also held to produce sore throat and symptoms of septic poisoning, and to contaminate milk and other food and water exposed to its influence. It may well be asked why has experience dictated all the elaborate precautions taken in regard to domestic drainage, why are soil-pipes placed outside houses, why are waste-pipes and other pipes trapped, why are cistern overflow-pipes cut off from drains? These precautions have been called for by the wide clinical experience of medical men and others of the evil effects of drain-air, surely a whole profession cannot have gone astray on this question?

Now, it may be asked, what are the conditions of construction in a combined drain? A combined drain we understand generally as a pipe or culvert of small calibre—the continuation of the drains of two or more houses to the sewer. Such a drain may be ærially connected with or disconnected from the sewer; the Reports we have just been considering would lead one to infer that this disconnection is unnecessary. Such a drain may also be ærially connected with or disconnected from the house-drains discharging into it, the Report does not allow us to infer that this disconnection is unnecessary, but rather the contrary, and for the following reasons:—That if infected from any one of the houses draining into it specific organisms will exist in the drain; that if the combined drain runs close to the house, and this is the common position, the splashing from the vertical soil-pipes and other pipes may project these organisms into the air, and, it may be added, hot vapours would tend to convey them upwards, and in the presence of any internal defect they probably would gain access to the interior of the house.

A combined drain, therefore, is more to be feared as a source of injury to health than either a sewer or a house-drain; because the possibility of survival of specific organisms are greater than in the one, and the chances of infection are

greater than in the other. To this it may be replied that if the house-drains were disconnected this would not apply. But combined drains are constructed for economy's sake; in the large majority of cases it is structurally impossible to disconnect the house-drains from them, and frequently they are laid either through, or under parts of houses, or else close to the external walls. It cannot be gainsaid that a combined drain taking the drainage of a series of houses and passing from the rear under a house to discharge into a sewer in the street in front must be an increased source of danger to the inmates of the house beneath which it passes. Recent experiments would make it appear to be even safer to let a public sewer run under a house rather than a drain from a block of houses. It is admitted that specifically polluted soil can spread certain diseases, it is difficult to understand how it is possible to deny that specifically polluted pipes and channels can also spread certain diseases. Therefore, from the point of view of health, combined drains are objectionable, except when they run entirely outside houses and at such a distance as to enable the house-drains to be properly and effectually disconnected from them.

Now, as to legal administration.

The 11 and 12 Vict. ch. 112, the Act of 1848 to Consolidate and continue the Metropolitan Commissions of Sewers, Sec. 147, and the 11 and 12 Vict. ch. 63, the Public Health Act of 1848, Sec. 2, both defined the word "Drain" to mean and include any drain of and used for the drainage of one building only on premises within the same curtilage, and made merely for the purpose of communicating with a cesspool or other like receptacle for drainage, or with a sewer into which the drainage of two or more buildings or premises occupied by different persons is conveyed; the word "sewer" to mean and include sewers of every description, except drains, to which the word "drain" interpreted as aforesaid applies.

This definition was re-enacted in the Metropolis Local Management Act of 1855, Sec. 250, and in the Public Health Act of 1875, Sec. 4, and was last interpreted and confirmed in the case of Travis *v.* Utley in 1893.* It is quite clear, therefore, that the Legislature always intended a channel, culvert, or pipe, carrying the drainage of more than one premises to be a sewer maintainable at public expense. If in the absence of a public sewer two or more houses that could not otherwise have been drained, have, at the time of construction, been drained through one culvert in order to reach the public sewer at a distance, and if, in later years, a public sewer has in the meanwhile been constructed so as to be accessible from each of the houses, and if

* For Report of this case see Journal, Vol. XV., page 298.

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the authority has subsequently desired that each house should be connected to the public sewer independently, it is clear that the Legislature intended that this also should be done at public expense. In the Metropolis this is borne out by the last paragraph of Sec. 69 of the Metropolis Local Management Act, 1855, which runs: "Provided also, that where the vestry or district board alter any sewer, or provide a new sewer in substitution for a sewer discontinued, closed up, or destroyed, they may contract or otherwise alter the private drains communicating with the sewer so altered, or with the sewer so discontinued, closed up, or destroyed, or may close up or destroy such private drains, and provide new drains in lieu thereof, as the circumstances of the sewerage may appear to them to require; but so that in every case the altered or substituted drain shall be as effectual for the use of the person entitled thereto as the drain previously used."

But the Legislature has made no general provision to enable Local Authorities to properly control the construction of drainage, to prove what has been agreed to and what has not been agreed to, to prevent a single drain being converted into a combined drain, and to stay the running of pipes in various directions, provided they did not touch the public sewer. This can only be controlled by means of plans, and there is no statutory provision in the metropolis, nor in many other towns, requiring plans of the drains of premises, consequently neither an authority nor an owner can prove anything but what is actually found on the discovery of a nuisance. This is at the bottom of all the troublesome disputes in reference to drains or sewers. It also explains how it comes about that houses have been constructed over combined drains—*quâ* sewers—although they are prohibited from being so erected. In the absence of plans the course of such sewers could not be known. This is well illustrated in the metropolis. In the Metropolis Local Management Act, 1855, Sec. 250, it is further provided that, "the word *drain* . . . . shall also include any drain for draining any group or block of houses by a combined operation under the order of any vestry or district board," this definition being subsequently extended by the Act of 1862, Sec. 112, to include "any drain for draining a group or block of houses by a combined operation, laid or constructed before the 1st day of January, 1856, pursuant to the order or direction or with the sanction or approval of the Metropolitan Commissioners of Sewers." If an Order authorizing combined drainage can be found it is clear that the owner is liable for its maintenance, but if no Order can be found, in the absence of a plan, the original system of drainage agreed to by the Authority cannot

be proved, and if at the time of the discovery of a nuisance the drainage of more than one premises be discharged through a drain, it has been decided that such a drain is a sewer, and must therefore be maintained at public expense. In other words, a person who has followed the legal course of obtaining an Order is mulcted, whilst a person who has neglected to obtain an Order, and has escaped the vigilance of the Authority, is relieved of expense.

It has already been said that the Legislature has made no general statutory provision requiring plans of drains to be submitted and approved by Local Authorities, and that it clearly intended any channel, culvert, or pipe carrying the drainage of more than one premises to be a sewer. But so far as the Metropolis is concerned it is provided in Section 69 of the Metropolis Local Management Act, 1855, "that no new sewer shall be made without the previous approval of the metropolitan board of works," and in Section 47 of the Metropolis Local Management Act, 1862, that "every person other than a vestry or district board intending to make or branch a sewer, either into a sewer vested in the metropolitan board of works, or into a sewer vested in any vestry or district board, shall in the first instance lay the plan and section thereof before, and apply for the sanction of, the vestry or district board of the parish, district, or part in which such last-mentioned sewers shall be situate; and no sewer shall be begun to be made by such person until the sanction *in writing* of such vestry or district board shall have been obtained." And in the following Section (48), it is further provided "that before sanctioning such private sewers, vestries and district boards must obtain the approval of the metropolitan board of works." Where are the records of these approvals, and where are the plans and sections, and if it can be proved that no such approvals were given to combined drains constructed since 1855, and now claimed to be sewers, what are the liabilities of private owners and public authorities respectively? These are questions for lawyers to decide, but a common layman would say that the Legislature intended, according to Sections 69 and 76 of the Metropolis Local Management Act, 1855, that no drains or sewers should be constructed without the approval of the vestry, district board, or metropolitan board of works, and no drains without notice being given to the vestry or district board, and in the absence of any proof of approval, or of notice being given, the local authority would not be liable.

Of course the whole trouble arises from the fact, as before stated, that the law made no provision for plans, and plans of sewers were not required until 1862, and that even now no

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general *statutory* provision exists for requiring plans of drains. The resolution of the Conference of Metropolitan Vestries and District Boards of the 17th May, 1894, that "any drain the plan of which has not been approved as a sewer under Section 69 of the Metropolis Local Management Act, 1855, . . ." shall be held to be a drain, is extraordinary, seeing that no plans were required and could not be required until 1862, under Section 47 of the Act of that year.

But, further, no notice to the Local Authority is, or has ever been, required before amending any drain. Therefore, once a connection obtained with the sewer from one house, there has been nothing to prevent such amendment of the drains or part of the drains of any adjoining premises from being tacked on without the knowledge of the Local Authority, and in such a manner as to lead to the formation technically of sewers. This has occurred wholesale in the Metropolis without let or hindrance, surface drains having been led by the shortest course to the nearest channel or pipe available. The nearest surface gulley of one owner had been led into a neighbouring owner's adjoining drain, converting the drain into a sewer, and enabling the first owner to claim an easement.

The question is thus very much complicated by right of easement. It is no exaggeration to say that it is not only possible for an owner to have a right of easement to drain parts of his drainage in two different directions, but it is within the bounds of possibility that an owner may have right of draining various parts of his premises in several different directions, perhaps three or four. The power of owners to thus saddle the general public with the maintenance of private drainage is illimitable, in the absence of plans and notice of amendment.

It raises also another question. Where does a drain end and a sewer begin? According to the definition in the Acts a channel pipe or culvert carrying the drainage of only one premises is a drain, but at the point at which it commences to carry the drainage of more than one premises it can no longer be a drain, but becomes a sewer. The definition says nothing about size, length, or direction, or private premises, or public way. Hence it is all the more difficult to understand certain words used by Mr. Justice Wills in his judgment, in the case of Travis *v.* Utley. "This drain is used for the drainage of more than one building. It is, therefore, a sewer. It is impossible to say that the part which is used for the drainage of one building is a drain, and the rest a sewer. The drain is a sewer from end to end." One would be inclined to ask which end in many cases, for it often happens that a drain, like a cat-o'-nine-tails, has a great many ends.

Now let us see how they are getting over the difficulty of combined drainage outside London. It is enacted in the Public Health Acts Amendment Act, 1890. "Section 19. (1). Where two or more houses belonging to different owners are connected with a public sewer by a single private drain, an application may be made under Section 41 of the Public Health Act, 1875 (relating to complaints as to nuisance from drains); and the Local Authority may recover any expenses incurred by them in executing any works under the powers conferred on them by that Section, by the owners of the houses in such shares and proportions as shall be settled by the Surveyor, or (in case of dispute) by a Court of Summary Jurisdiction. (2) Such expenses may be recovered summarily, or may be declared by the Urban Authority to be private improvement expenses under the Public Health Acts, and may be recovered accordingly. (3) For the purpose of this Section, the expression 'drain' includes a drain used for the drainage of more than one building."

It will be noticed that for the first time we here have mentioned a "*public* sewer" and a "*private* drain." The inference is that it may also be possible to have a *private* sewer, and a *public* drain. It will also be observed that the section only deals with houses "belonging to different owners."

This Act is not a compulsory but an adoptive Act, and any authority outside London adopting the Act modifies the definition of the word "drain," as defined in the Public Health Act, 1875.

The effect of this Act was seen in the recent case of Self *v.* the Hove Commissioners, in which it which it was held that the owners of two houses drained by a combined drain were liable for the expense of laying a new drain, and that the authority was not liable.

This Section 19 of the Public Health Amendment Act of 1890, where adopted, appears to have provided a means of getting over the difficulties in certain cases of combined drainage, but the Metropolis is excluded from the power of adopting it.

From what has preceded, it may be concluded that before questions of combined drainage can be settled on satisfactory bases by Local Authorities, we require from the Legislature clear definitions of a public sewer, a private sewer, a public drain, a private drain, a new drain or sewer, a reconstruction, and an amendment, and further definite provisions as to giving notices and as to furnishing plans.

[*For discussion on this paper see page* 289.]

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COMBINED DRAINAGE,

FROM THE POINT OF VIEW OF HEALTH, CONSTRUCTION, ADMINISTRATION, AND LAW.

By W. Nisbet Blair, Assoc.M.Inst.C.E., Surveyor, St. Pancras.

Read at the Sessional Meeting April 3rd, 1895.

Perhaps the strongest argument against the single drainage system is that it so frequently involves the laying of drains under the houses, and it is generally recognised that it is not desirable to lay drains under a house if it can be avoided, but a decision for or against should only be arrived at after consideration has been given to the alternative conditions which occur in each case. Where each house is drained separately to the sewer, and the work has been carried out in a manner approved under modern regulations, there can be no risk to health even with a drain passing entirely under the house, of course all openings communicating with the drain being outside the house. The occupier then has sole control of the drain, if it should be stopped, the stoppage has been caused on his own premises by the admission of improper matter to the drain, such as a floor cloth or perhaps a brush, and he is the first to be inconvenienced and can at once cause it to be cleared. Such stoppage would be indicated by overflow at a low level grid, and if promptly dealt with, no cause of injury to health would ensue. But with combined drainage the flooding would take place so much more rapidly in proportion to the extent of the property connected to the system, and the sufferer may not be the person to blame for causing the stoppage, nor is it likely its removal can be effected so readily, as it is more difficult to localize the point of stoppage. Not only has the innocent to suffer for the guilty, but he probably has to pay the cost of the cure as well. There is another important consideration, viz., the improper tampering with drains, should a person, not influenced by a proper appreciation of his obligation and duties towards his Sanitary Authority as well as to his neighbours, desire to make some addition or alteration to any part of the drainage of his premises, he may do it without supervision and by careless or incompetent workmen may cause a stoppage which will flood his neighbours while he may escape inconvenience.

Under such a condition of things it is not difficult to understand that the system of single drainage is favoured by those conversant with the subject.

WITH REGARD TO CONSTRUCTION.

On the question of cost, there is no doubt that contiguous buildings can be drained at less cost by the combined system than by single drainage, for it is a costly operation to open an expensively paved road, either of wood or granite, to sink down to perhaps twenty feet in depth to the sewer, and to cut a trench or drive a heading half the width of a street before the premises are reached. The great inconvenience caused to the public in the street, not only to pedestrian traffic, but to general vehicular, and perhaps tramway traffic also, should be avoided if reasonably possible. The cost of the work on such premises is probably greater for single than for combined drainage, for as a rule most of the connections are at the back of the house, and have to be laid at a greater depth to be brought through under basements to the front.

The usual practice in London is to erect long blocks of houses with no separate access to the back of the property, whereas in many of the northern towns it is usual to form a back passage or narrow street to give an approach to the gardens or yards, and for emptying the ashpits. In such cases the owner is required to lay out and form the passage in accordance with the regulations of the Sanitary Authorities; a pipe sewer 9 in. or 12 in. in diameter, is provided to receive the drainage of the houses on both sides of the passage. The sewer is constructed at the cost of the owner, and when satisfactorily completed, is adopted and maintained by the Sanitary Authority.

The Engineer to the Corporation of West Ham, whose experience on this matter is very wide, and his authority admitted, says in reporting to his Corporation:

"The system known as 'Combined Back Drainage,' that is, the connection of groups of houses with lines of pipes at the rear, so far as practicable to avoid drainage under houses, has been a general practice since the passing of the Public Health Act of 1848. It was the system advised by the General Board of Health, and recognised and re-advised by the Local Government Board under the Public Health Act of 1875. The Model By-Laws issued by the Local Government Board in 1877, require that 'no drain shall pass under any building except where any other mode of construction may be impracticable.'"

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With detached or semi-detached houses the case is somewhat different, as property of this class covers a much greater frontage, and to drain each house separately to the sewer would probably require no greater length of drain than to connect the branches into a common drain at the back of the property.

Administration.

So far as the Administration is concerned the separate system of drainage is unquestionably preferable. When a nuisance occurs on any premises drained separately to the sewer, its cause is much more promptly ascertainable, its position localised, and its remedy prescribed. There is less difficulty in obtaining information as to ownership, and any subsequent procedure to secure compliance with sanitary notices is simple and straightforward. It is of the greatest importance that the nuisance which may exist should be removed without unnecessary delay, but delay is unavoidable where several houses are drained together, and examination requiring the ground to be opened to locate the position of the defect or stoppage, frequently runs into several days before the notices can be even properly prepared. There is, moreover, great annoyance caused, apparently without sufficient reason, where a request is made on a householder to permit the ground to be opened, and the drain exposed, in his kitchen perhaps. He may not be aware of the stoppage of the drain if his connections are below it, and he may object to his house being upset by workmen engaged on what is not the most inoffensive work. A notice must then be served upon him, and its expiry awaited. The drain is not always found at the first point of opening, and the whole of the basement floor may be either trenched through or covered with clay or polluted earth, and the air is filled with the odour of carbolic powder or other smells, which are often the subject of greater antipathy than the original evil. The unfortunate tenant has to suffer all this because someone in the household of his neighbour has disposed of a worn-out garment or other rubbish by means of a domestic convenience connected to the drain, instead of by the dust-bin or by burning.

Where so much time and labour is involved in the discovery of the cause of a nuisance, the staff of the Local Authority must be larger than it need otherwise have been; the cost to the ratepayer is also increased by the labour item, and the same pocket may have to pay for the reinstatement of walls, flooring, &c., for it does not seem to be usual to charge upon the owner the cost incurred in the discovery of the cause of any nuisance.

The authority may serve notice upon an owner to open the

ground and expose a drain for examination by an Inspector, but if this course were adopted, the loss of time and consequently greater danger to health would be increased almost *ad infinitum*, for the owner may not at once employ a builder; he will probably interview the officers of the authority and argue that he knows the drain is all right, and will offer to bring forward the builder who laid it perhaps some years before. But even when a builder is engaged, he cannot possibly commence until "next week."

Combined drainage is supposed to exist only where it has been approved either by the Metropolitan Commissioners of Sewers or by a Vestry or District Board, but there are many cases, one might say many thousands of cases, where, possibly by reason of want of supervision, but more probably by the deliberate act of a builder or other person, combined drains have been made without the requisite order or approval, and these are usually found to be of the worst form of construction and arrangement. It is on this point that the recent difficulties of Local Authorities have arisen for it has been declared that a combined drain made as such, even by the illegal act of the person so making it, becomes a public sewer, and is maintainable by the Local Authority so that many "drains," regarded as "drains," by the persons who made them and which ought still to be "drains," have now to be regarded as "sewers," and the ratepayers are liable for their maintenance. It will be necessary to refer again to this question under the next heading.

As Regards the Law.

The statutes applying to London provide:—By Section 73 of 18 and 19 Vic. c. 120, that any house may be required to drain to a sewer, if there be a sewer within 100 feet of the house (this distance is extended by 200 feet by Section 66 of 25 and 26 Vic. c. 102) in a manner to satisfy the Vestry or District Board, and if the owner neglect during twenty-eight days after notice to commence to comply, the Vestry or Board may execute the work and recover the cost from the owner.

Section 74 of the same Act empowers a Vestry or Board to order that a group or block of houses be drained by a combined operation *if it appear to the Vestry or Board that such group or block of houses may be drained and* IMPROVED *more economically or advantageously in combination than separately.*

Section 75 makes it unlawful to erect any house unless its lowest floor can be satisfactorily drained to a sewer.

Section 76 forbids the excavation of any foundations of any new house or the making of any drain until seven days' notice

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shall have been given to the Vestry or Board, so that the Vestry or Board may make their order as to the level of the lowest floor of the house, or as to the making of such a drain.

The inference to be drawn from these sections is, that each house shall be separately drained to the sewer where reasonably practicable, and the authority to order combined drainage is to meet exceptionable cases in which it must be shown that the drainage is *improved* by being combined with that of other houses, owing to there being a practical difficulty in constructing separate drainage.

The definitions of the word "drain" in the Acts of 1855 and 1862, clearly limit the name to that which receives the drainage of one building only, or premises within the same curtilage, unless it can be shown that a drain for draining any group or block of houses, by a combined operation, was laid under the order of a Vestry or District Board or the Metropolitan Commissioners of Sewers. To prove that this order was made falls upon the Local Authority, and their cause is often lost by their inability to do so, for when the work was done *surreptitiously*, as it must have been in nine cases out of ten, they cannot expect to find any record of it, and the very inequitable burden of maintaining it as a sewer falls upon them.

To meet this difficulty the vestries of London are endeavouring to secure an alteration of the law by extending the meaning of the word "drain," by adopting the words "and any drain the plan of which has not been approved as a sewer under Section 69 of the Metropolis Local Management Act, 1855, and Sections 45 and 48 of the Metropolis Local Management (Amendment) Act, 1862," and the London County Council, as the representative body of London as a whole, is being pressed to bring about this alteration.

As applied to the rest of the country the legal position of the question of combined drainage is somewhat different, for it is not sanctioned at all.

Section 23 of the Public Health Act, 1875, empowers an authority to require the owner or occupier of any house to drain such house into a sewer where such sewer is not more than 100 feet from the site of such house in accordance with the directions of the authority.

The Amending Act of 1890 recognises the existence of combined drains, but by Section 19 fixes the liability for their maintenance on the owners, but curiously that section only takes effect "where two or more houses belonging to different owners are connected by a single drain to the sewer," so that where several houses belonging to one owner are drained together, such drain is a sewer and must be maintained by the Local

Authority. The decision in the case of Travis *v.* Utley fixing the liability to repair a defective drain which drained three houses, upon the Local Authority, roused up almost every sanitary authority in this country to realise its position, but it has only recently come to light in the case of Self *v.* Hove Commissioners that the Public Health Amendment Act, 1890, had not been adopted by Halifax where the property in Travis *v.* Utley was situated. The adoption of this Amendment Act is optional, and the omission by Halifax was not reported until the Court of Appeal had the case of Self *v.* Hove Commissioners under consideration. In this case the Court (Wills and Wright, Justices), decided that the Hove Commissioners were not liable for the cost incurred in reconstructing a drain, which it was discovered drained the house adjoining that on which a nuisance notice had been served. The owner did the work relying on Travis *v.* Utley to be repaid the cost by the Commissioners. An action in the County Court secured a judgment against the Commissioners, who appealed and succeeded in getting the judgment reversed. This decision will give provincial sanitary authorities an opportunity to breathe again with a feeling of relief, but it is considered that the anomaly in Section 19 of the Amending Act of 1890 must be removed, and a Bill, promoted by the Association of Municipal Corporations, is now before Parliament which describes a private sewer as draining the property of one or more owners, and it renders him or them liable for its maintenance, but there is no suggestion made that houses under certain conditions may be better drained in combination than separately, and sanitary authorities have no power given them to approve of combined drainage.

Another difficulty exists in the recommendation of the Local Government Board in their Model By-Laws, which provide that no drain shall pass under any building except where any other mode of construction may be impracticable. What is to be done in the case of a terrace of houses? There must not be combined drainage, and the drains must not be laid under the houses. There are two courses open; either the authority must construct, at its own cost, a sewer along the back of the terrace, and pay claims for easement if not for damages, or several houses must each have a drain crossing the premises dividing them from the nearest public sewer. Is the owner of one house likely to consent to the owners of three or four other houses laying a drain for each house in a separate line across his premises?

The simplest form of relief from this position is the modifica- or withdrawal of the Local Government Board By-Law, but it

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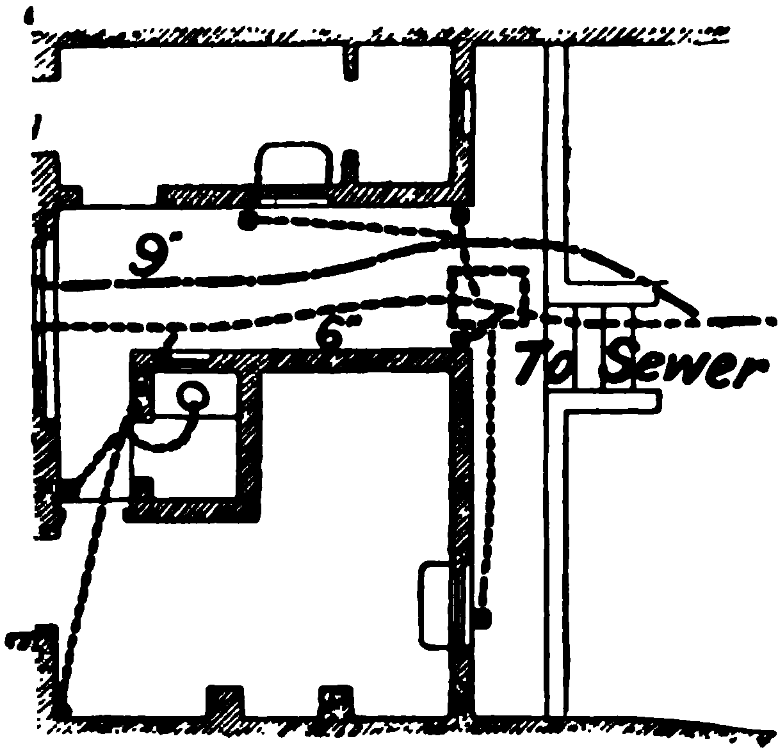

T and dots and dotted lines respectively.
T r property, while that shown in dashes
al in other occupation, at the rear of the
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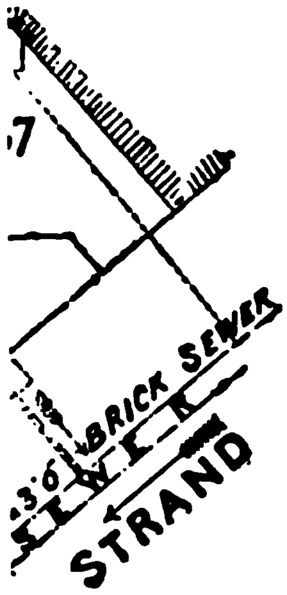
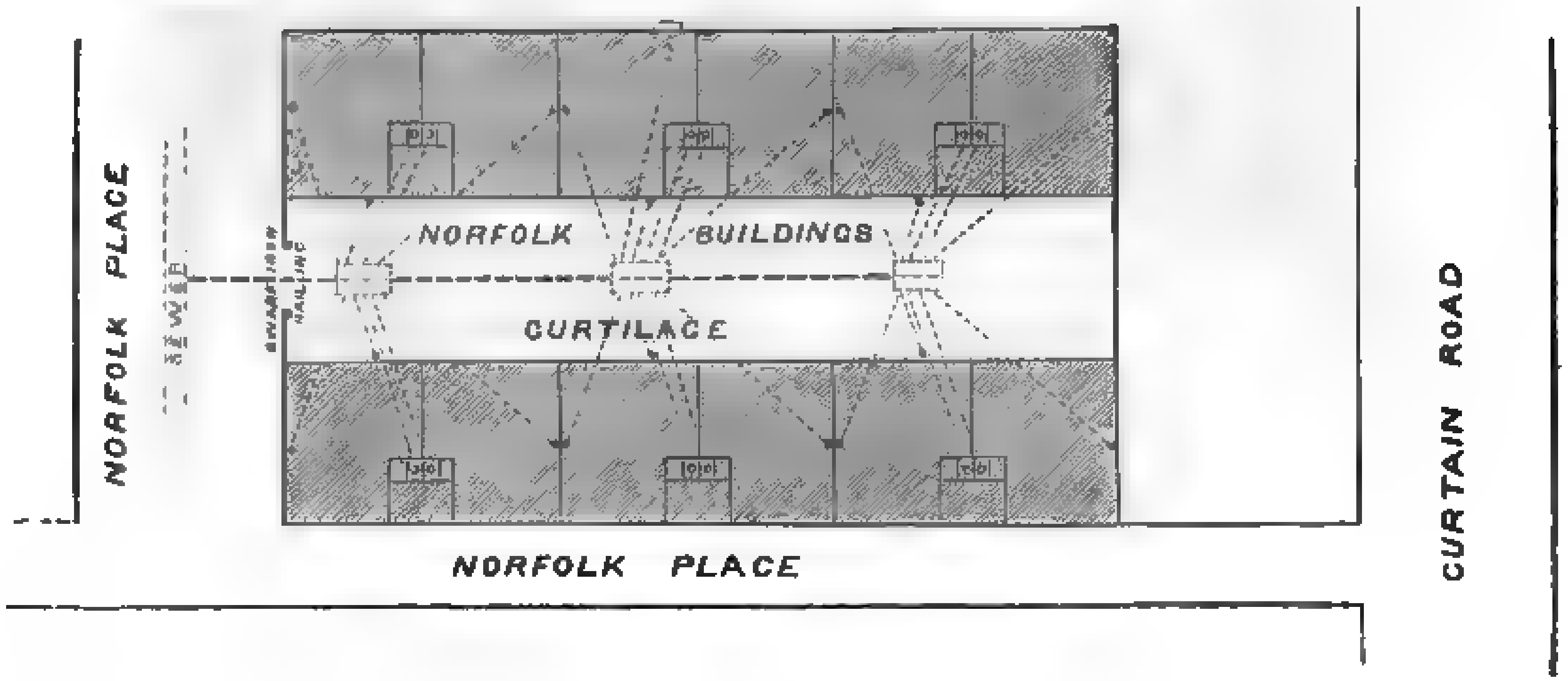
ot

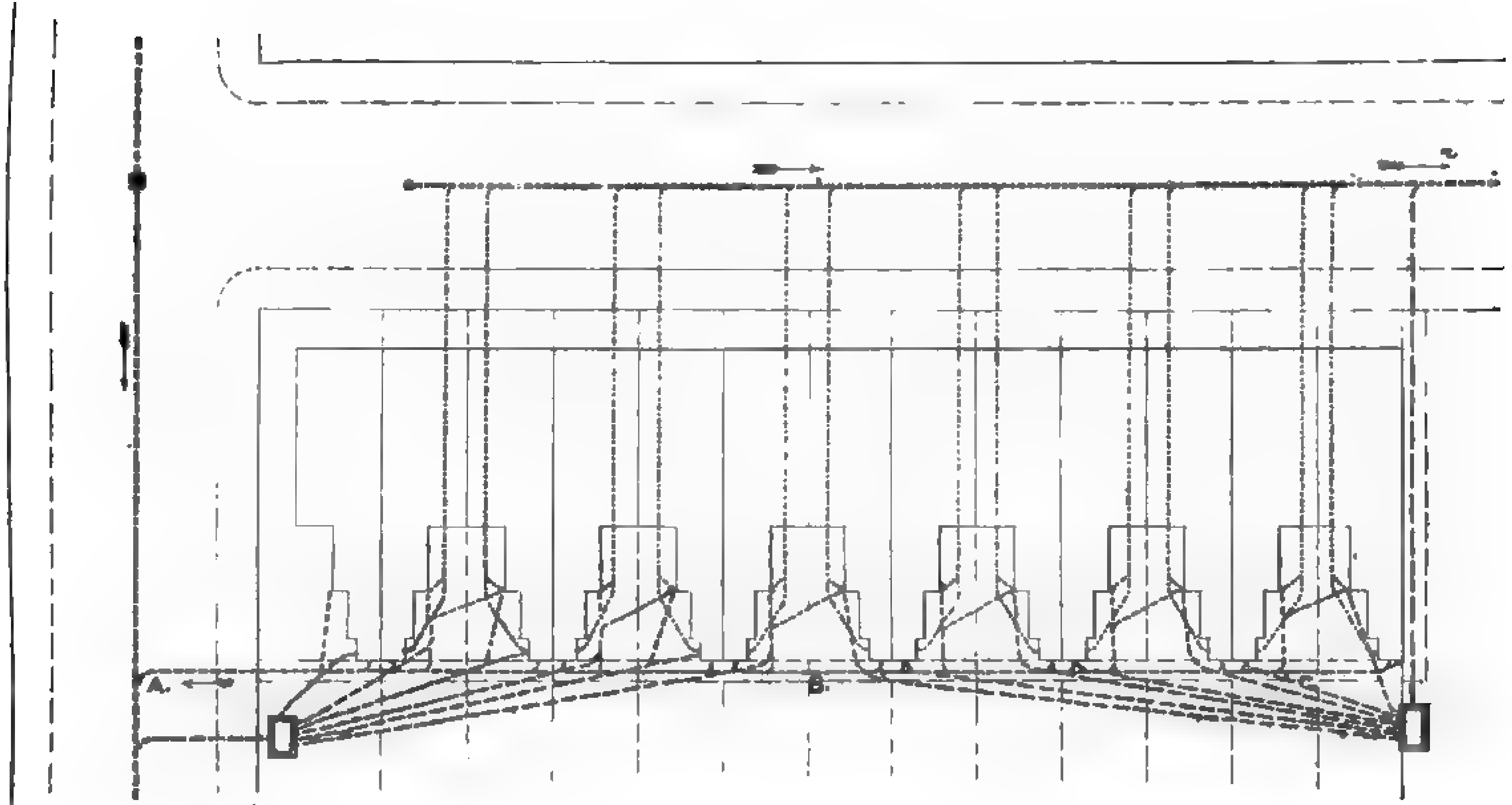


ιtes at each end.
ιd not a drain.

PILBROW *V.* THE VESTRY OF ST. LEONARD, SHOREDITCH.



No. 4. Diagram. In this case it was held that the combined drain, shown by the thick-dashed line, was a drain and not a sewer.



No. 5 Diagram illustrating alternative methods of avoiding combined drainage at the rear of a terrace of houses.

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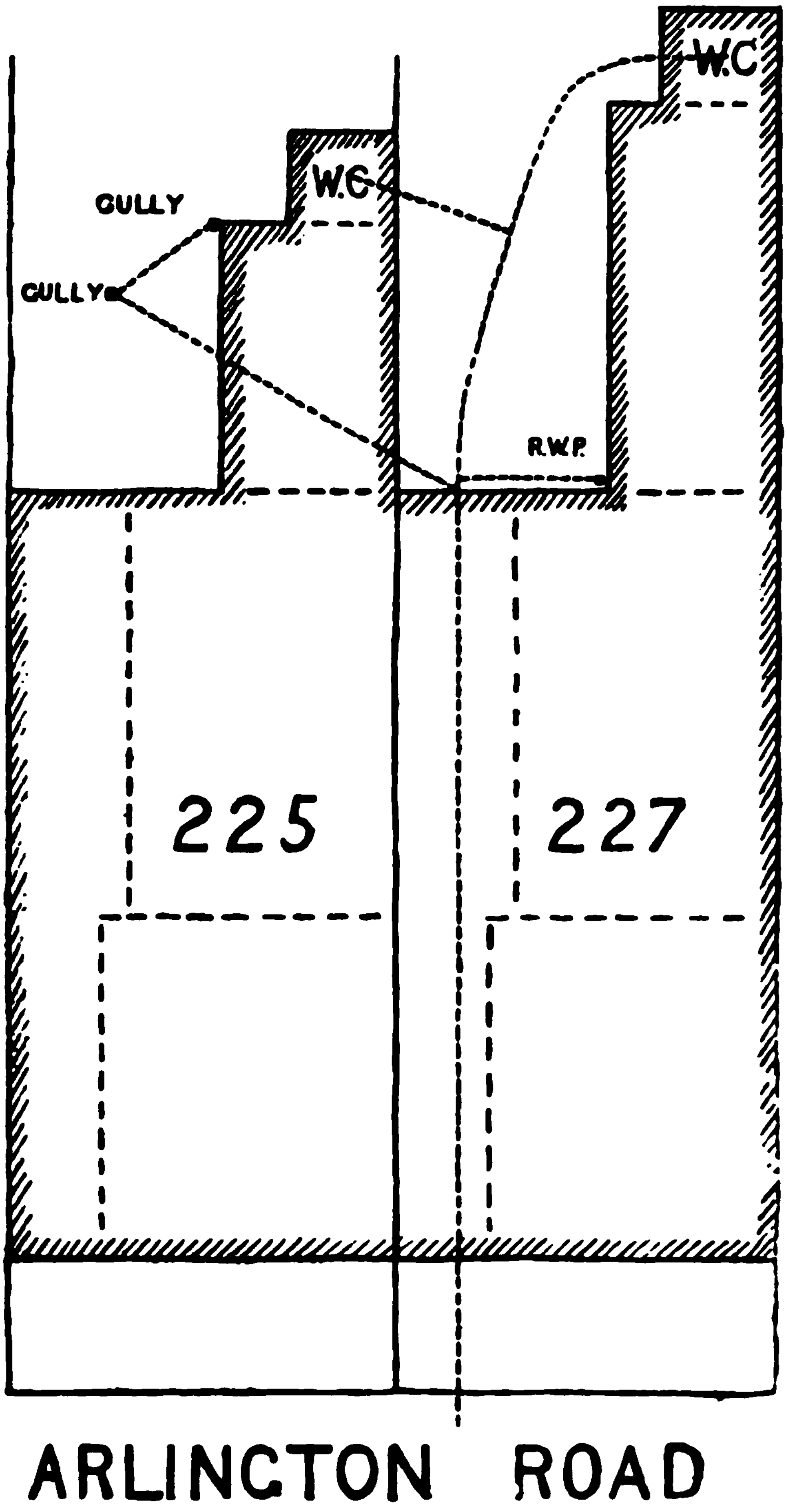
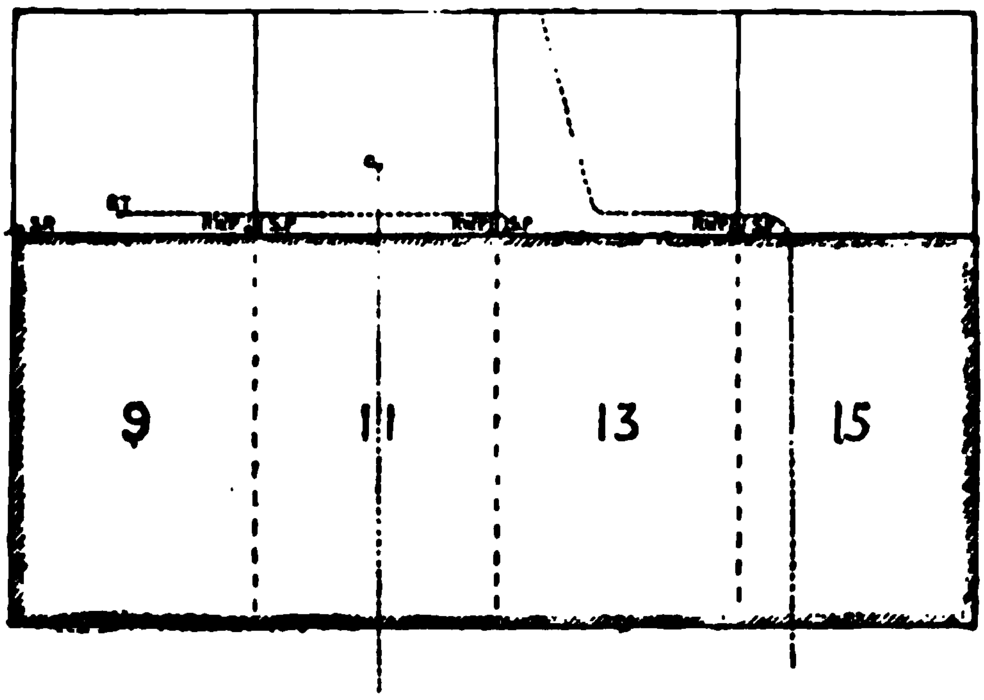


No. 6 Diagram illustrating drainage executed without notice or submission of plan; and this very illegality constituting a sewer what would otherwise have been a combined drain.



HAWLEY STREET

No. 7 Diagram illustrating drainage probably executed surreptitiously, and converting drains into sewers.

[redacted]

seems very desirable that a provision should be introduced into the Bill now before Parliament authorising a Local Authority to approve combined drainage, where the circumstances seem to them to show that by such a course the drainage of a house may be improved.

Diagrams illustrating the various cases referred to in these papers face page 288, and for the use of some of them the Authors desire to acknowledge their obligation to Mr. Robert Godfrey, Engineer to King's Norton Rural District Council, to Mr. Lewis Angell, Engineer to the Corporation of West Ham, and to the proprietors of *The Contract Journal.*

[*This discussion applies to the two preceding papers.*]

Mr. Lewis Angell (West Ham), on being called upon to open the discussion, reminded the meeting that West Ham had taken a prominent part in the question of combined drainage. His Corporation had issued a letter calling the attention of local authorities throughout the country to the subject, and asking their view; most of those who replied supported the view of West Ham, but from the Local Government Board he got no reply beyond an acknowledgment to several applications. The question was a very complex one. He could not agree with Dr. Sykes that combined back drains should be public sewers, his experience was quite the opposite, for by adopting this plan it would be accepting a great number of irregularly constructed drains. The length of sewers in his district (West Ham) for example, would be extended from about 100 miles to 400 miles. Formerly, when defects were found on private premises notice was served on the owner to remedy them, but now the Sanitary Department served notice on the Local Authority instead of on the owner. It was an anomaly and an absurdity that combined drainage belonging to one owner should be a public sewer, but the same arrangement if belonging to more than one owner should be a private drain, by this provision the same drain may one day be a private drain and the next day a public sewer by a mere change of ownership. It also appeared that if a new drain were surreptitiously connected with a public sewer, the existing old drain might then become a private drain. In the olden time, and in fact until quite recently, sanitary supervision was not appreciated by local authorities, and their officers had great trouble in obtaining proper supervision of work, but now with the new sanitary "boom" there was a great influx of Sanitary Inspectors to look up defects which appeared to the disadvantage of the old officers although they had really been helpless from the want of assistance. His district now had twelve or fourteen Sanitary Inspectors working as detectives discovering evils which should have been prevented under proper supervision. What he had

wanted in the past was a preventive service adequate to supervise new work and alterations so as to prevent the evils perpetrated under private drainage, in which case there would have been less necessity for a detective service now. It was a very serious thing, as in West Ham, to have the responsibility for some 300 miles of imperfect private drains thrown on the rates.

Mr. Wm. White (London) thought that with all the complications that must arise it was very undesirable that there should be public sewers on private property or private drains on public property. No combined drain should be allowed unless there was an inspection chamber at each end and the means of testing and examining as well as of ventilating the drain.

Mr. J. P. Norrington (Surveyor of Lambeth) said that the question was giving a good deal of trouble to him in his parish and to surveyors generally, and the law should be amended. He did not agree with Dr. Sykes when he stated that in his opinion it was the intention of the legislature that any drainage by a combined operation should be considered a sewer; on the contrary, he did not think the legislature ever contemplated that the present state of things would arise, and that the present trouble was the result of an oversight as to the importance of the definition of the words "drain" and "sewer." The Association of Municipal Corporations was making an effort to get these definitions amended, and at the same time some further regulations were needed with reference to the compulsory deposit and approval of plans of drainage.

Mr. C. Mason (Surveyor, St. Martin's in the Fields) admitted that nothing could be done to improve the present anomalous conditions until the law was altered and a proper definition of a "drain" and a "sewer" given. He did not agree that all combined drains should be considered sewers, and thought that the fault lay in the drafting of the act. There were cases in which parishes were spending five or six thousand pounds a year on what he considered private property.

The Chairman (Prof. A. Wynter Blyth) quite agreed with Dr. Sykes with regard to the report on the experiments on Sewer Air, that it was not safe from such experiments to draw general conclusions. All experience shews that sewer air does cause illness: he also agreed with Dr. Sykes that it was intended in drafting the Acts that a combined drain should be treated as a sewer from the point of junction, as this is the reading of three separate Acts passed at intervals and has been supported by several legal decisions. No new point has been raised by these decisions, but in the past years Local Authorities had been serving notices beyond their powers and the owners had complied with them, but the action taken by The Sanitary Institute in teaching and popularising Sanitary Law has called the attention of many to these provisions, and has helped to bring the matter forward. It is, of course, easy to find fault with these pro-

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visions, but it is not easy to suggest a satisfactory amendment. An amendment of the law has been suggested in a Bill promoted by the Association of Municipal Corporations, but he was not sure the propositions contained therein would prove satisfactory. A mere alteration of definition would not meet the case, as this has been tried in the Public Health Amendment Act, Section 19. The only suggestion he could see would be to appoint some central authority to whom all cases could be referred to decide each on its merits; at the same time he agreed that further legislation was necessary.

Dr. J. F. J. Sykes (St. Pancras). With regard to Prof. Blyth's suggestion for a Court of Appeal, he thought that this already existed in the Vestries and Local Authorities,—it generally came to a question of compromise. He repeated that it was strongly his opinion that the Legislature did intend old combined drains to be treated as sewers, and this would be made clearer if their history was followed. Many years ago the common ditch received the drainage of the adjoining houses, and it was intended that the Local Authority should cover these ditches in—in some cases this was done by the private owner, but it did not relieve the Local Authority from the responsibility.

Mr. W. N. Blair (St. Pancras), in replying, said he certainly thought that it was the intention of the Legislature that open ditches and water-courses when covered in or culverted should be sewers, but it was never intended that house drains should be surreptitiously converted into public sewers by the joining of one drain to another. As to the Local Authority exceeding its powers in these cases in requiring owners to repair defective drainage, he thought they were quite justified in doing so.

REVIEWS OF BOOKS.

"THE LAW RELATING TO PUBLIC HEALTH AND LOCAL GOVERNMENT."*

When a standard work like the present reaches the eleventh edition the task of the reviewer is easy and his work may well be confined to pointing out additions and improvements.

This, the very latest contribution to sanitary law, is at the same time the most complete. Its possession by a Sanitary Officer in the provinces gives him the whole law relating to the powers and duties of his local authority, and it only has to be supplemented by the Metropolis Local Management Acts, by the London Public Health Act, and by the London Building Act for the same remark to apply to metropolitan officers.

The first volume consists of 704 pages and is wholly occupied with the Public Health Act of 1875. The Act is set out verbatim and after each Section there are explanatory notes and references to decisions in the superior Courts of Law. These decisions are well up to date, take for example the definition of sewer and drain, and it will be seen that Travis *v.* Utley, the Lowther Arcade case, and the important recent decisions as to the meaning of "curtilage," are all set forth in brief, and their bearing discussed.

Some of the notes are of considerable length far exceeding the text, for instance the commentary on Section 4 occupies nearly 23 pages.

At the end of this same volume is placed the index to the whole work, the edges of the index pages are tinted red, a convenient method well worthy of imitation. As a rule the index to legal works is badly done, and it is at once a surprise and a pleasure to find that in this case immense pains have been taken to give a complete and most convenient index.

The second volume consists of the principal statutes passed up to the end of 1894, under which District Councils have powers or duties or in which they are otherwise immediately concerned. These are arranged in chronological order, commencing with the Knackers' Act of 1786 and ending with the Merchant Shipping Act of 1894, no fewer than 121 statutes or portions of statutes!

The Local Government Act of 1894 is annotated by Mr. A. F. Jenkin, of the Inner Temple, who has published a separate work upon that Act.

After the statutes named come the instructions, memoranda and

* The Law Relating to Public Health and Local Government. Being the Public Health Act, 1875, and other statutes affecting District Councils, by the late William Cunningham Glen, Barrister-at-Law. Eleventh edition by Alex. Glen., M.A., LL.B. Cantab., Barrister-at-Law of the Midland Circuit; including the Local Government Act, 1894, and the statutes and orders relating to the election of District Councils by A. F. Jenkin, Barrister-at-Law. *2 Vols., 8vo., 1864* pages, price £3 3s. Knight & Co., London, 1895.

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orders of the Local Government Board of any present importance, also in chronological order and ranging from 1876 to the end of 1894.

Tables of cases, of statutes, and of reference from repealed statutes have also been added.

The ability and conscientious industry with which this work has been prepared merits the highest commendation. Essentially *the* work of reference for the lawyer, it will also find its place in all public libraries and be consulted by sanitary officials and members of local authorities.

A. WYNTER BLYTH.

SANITATION IN INDIA.

The Medical Congress which assembled recently in Calcutta has done much to call public attention to the pressing need for further enlightenment both of governors and governed on the subject of public health in India. Those who are familiar with that country will not be surprised to learn that in all discussions on this subject cholera is always assigned a very prominent position, the views held by experts in the East and in the West differing very widely as to origin, methods of propagation, and spread of this terribly fatal malady. The writer is old enough to remember the origin and development of opposing schools of thought regarding the etiology and epidemiology of cholera which found graphic expression in some doggerel lines written some twenty-five or more years ago by Dr. Edwin Saward, Drs. Macnamara and Bryden being the then prominent representatives of the respective parties.

The Western theory, or the creed of Macnamara:

> "Man-bred and man-shed, anon diffused in water-bed;
> Multiplied and further spread, thus the pest o'er earth has sped."

The Eastern theory, or faith of Bryden:

> "Earth-grown, wind-blown, air and vapour-hatched and sown;
> Thus the pest o'er earth has flown."

The great advances made in bacteriology and pathology since these lines were written has done much to throw the respective theories into the shade, and to substitute for them others which it would be hazardous to say, in the still imperfectly developed state of these sciences, are altogether beyond criticism. Men speak of eating and drinking cholera, and of the spread of the disease by water and by articles of food, without giving much heed to the methods by which such supplies are contaminated. In great centres of population, where for example water is drawn from a common source and distributed through known channels, it is easy to understand how the source may be infected, and the community drawing its supply from such a source may thus suffer; but in a vast continent like India, where the great mass of the people draw their water supply from wells having no communication with each other, a further agency appears to be necessary for the spread of the infective material. Granting that this agency exists in human intercourse, it

is still further necessary to account for the often epidemic form in which this disease prevails, and its abrupt subsidence, for which no sufficient reason has been discovered.

Meantime it is pleasant to turn to the men of light and learning in this greatest of England's possessions, and to take an unprejudiced view of what they can lay before their readers on the all-important subject of the prevention of disease.

Two valuable contributions have recently been made to the Library of The Sanitary Institute by officers of the Madras Medical Service, whose knowledge of all matters bearing upon the public health in this great Eastern Empire is well up to date.

THE ELEMENTS OF SANITARY SCIENCE.*

An unpretending handbook of some 260 pages, compiled for the use of District, Municipal, Local Medical and Sanitary Officers, Members of Local Boards, Municipal Councils, and others. The author, who had been Professor of Hygiene in the Madras Medical College, and was then acting as Deputy Sanitary Commissioner, was well aware of the need that existed for such a work. It is especially true of that Presidency, and indeed of all India, that "many persons who are otherwise well educated have been taught little or nothing of the science of health, and suffer individually thereby; while general sanitary authority is vested in corporations whose members often feel the need of a guide to the principles of public sanitation, and who are, for want of it, unable always to spend the public money to the best advantage of the public."

This handbook, modestly described by its author as a "little work," contains a very concise and interesting summary of all matters relating to health, which those who are entrusted with sanitary administration should have at their fingers' ends, and which every member of the community who desires to guard his own health, or that of his family, against needless physical deterioration and premature death should study. After a brief introduction on health and disease, there are interesting chapters on food, water and air, both of which, by-the-bye, are said to be channels for the communication of cholera, although the cholera infection, and also that of enteric fever, "are less readily communicated by air" than those of the eruptive fevers, mumps, and whooping cough. Other chapters on the removal of waste, on soil, climate and meteorology, houses, personal hygeine, parasitic and microbic diseases, vital statistics and sanitary law, make up a very useful and readable text-book, which any fairly educated person can understand. The Madras Medical Service may be congratulated on the good work done by one whose brief but brilliant career reflects honour upon it. His early death was greatly regretted by his many friends.

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* The Elements of Sanitary Science. By Surgeon-Major C. J. McNally, M.D., D.P.H. 8vo., 267 pp. Government Press, Madras, and H. K. Lewis, *London.*

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THE INDIAN MANUAL OF HYGIENE.*

A work of considerable pretensions. In as far as it has yet seen the light—the first volume only having been received—it is stated to be a revised, re-arranged, and in great part re-written edition of King's "Madras Manual of Hygiene." A voluminous preface and introduction, extending over 123 pages, is devoted to the discussion of the past, present and future of public health topics, on lines which give promise of an exhaustive review of the whole field of sanitary science. In laying down the principles on which sanitary officers should be trained, it is gratifying to note that the author quotes in detail the course of lectures and demonstrations given at The Sanitary Institute to candidates who wish to qualify for Sanitary Inspectorships. Following the introduction there is a well written chapter on air, in which the principles of ventilation are fully discussed. Here too, as in *The Elements of Sanitary Science*, it is stated that the air may be the medium of communicating cholera: "The blood may be poisoned by air inhaled, containing the specific virus of cholera, typhus, typhoid, paludel fevers, dysentery, variola, scarlatina, or measles." The chapter on water deals with the search for and the methods of estimating the extent of supply available, storage and distribution, drinking water and diseases resulting from its impurities, filtration, and methods of examination. The principles enunciated in this chapter do not differ materially from those to be found in any good text-book on the subject, due allowance being made for the special needs of those for whom Dr. Grant is writing. Ice-water is an illustration in point: "Ice-water is *flat* and unpalatable, but the usual addition in India of aerated waters to ice lessens this quality. In America the constant use of iced water, *i.e.*, water frozen solid in vessels and then drunk whilst melting, is the cause of a considerable amount of dyspepsia." There is no allusion to the other addition in the form of brandy or one of its substitutes, which contributes to make the iced beverage palatable to the Indian consumer, and possibly to the American also, although in the latter case it does not ward off the troublesome dyspepsia here attributed to indulgence in ice-water. A little further on Dr. Grant says: "A very sudden and localized outbreak of either enteric fever or cholera is almost certainly owing to the introduction of the poison by water," to which is added a note, that "it may be in the form of ice." Presumably the teaching here set forth is only intended to imply that a temperature of 32° F. is not capable of rendering the bacillus of enteric or cholera inert. Ice as such, provided it is pure, cannot produce either enteric fever or cholera. Chapters on soil, disposal of waste matter, buildings, and climatology, complete the volume. The volume is well printed on good paper, but the list of *errata et corrigenda* given on pages xxxix. and xl. is not creditable to the printer.

T. CRAWFORD.

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* The Indian Manual of Hygiene. By Surgeon-Captain A. E. Grant, M.B., Professor of Hygiene, Madras Medical College. 8vo., 442 pp. Higginbottom & Co., Madras.

SOME LECTURES BY THE LATE SIR GEORGE E. PAGET, K.C.B., M.D., F.R.S.*

Regius Professor of Physic in the University of Cambridge.

The life of the late Sir George Paget, measured by any standard which the general public can apply, must be judged to have been singularly fortunate. He devoted himself in early life to the task of reviving the Medical School of Cambridge, and was fortunate enough to bring to his work the prestige of conspicuous success as a student of those subjects which alone could command the respect of those who were then the rulers of University affairs. Before maturity was passed he knew that the fulfilment of his hopes was assured, and in old age he was happily permitted to see their complete fruition. He was ably seconded. In Sir George Humphry he found a colleague loyal to the same ideal, and later, there grew up around these two pioneers a whole school of younger men worthy to continue the work. Medicine in England owes a deep debt of gratitude to Sir George Paget, and those who are given more particularly to the study of sanitary questions will not forget that the University of Cambridge early recognised the importance of their studies by instituting, during the time when his influence was strongest in Cambridge, the Diploma in Public Health.

This book is valuable, thus, as a memorial of a man who deserved well of Medicine and Sanitary Science, and its interest is increased by the brief biographical notice which Mr. Charles Paget has prefixed. It might have been fuller, but probably it is all that we are to expect, and as long as Sir George Paget's influence on medical education in Cambridge, and indirectly throughout the country, is remembered, perhaps no more elaborate biography is needed. The lectures, which form the bulk of the volume, are of no little intrinsic merit. They contain the opinions of a physician of ripe experience and of remarkable sobriety of judgment on several subjects which are still burning questions of the day. The two lectures on Alcohol as a Cause of Disease, which, together, fill nearly half the volume, are particularly well worthy of perusal. The physician will admire the accuracy of the clinical observation which enabled Sir George Paget to recognise and describe so well the effects of alcohol on the peripheral nerves at a time when this subject was little understood, while those readers who are unfamiliar with medical terminology, will find that the style is clear and free from anything approaching pedantry in the use of medical terms. The lectures, indeed, may all be read with interest and advantage by any intelligent layman, while they are at the same time not less suggestive and valuable subjects of study for medical readers. This is a rare quality in medical writings,

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* Some Lectures by the late Sir George E. Paget, K.C.B., M.D., F.R.S. Edited from MSS., with a Memoir by Charles E. Paget, Medical Officer of Health for the County Borough of Salford. Cr. 8vo., 192 pp., price 5*s*. Macmillan and Bowes. Cambridge, 1893.

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but a reperusal of the lectures confirms the impression of the justice of the opinion here expressed.

Mr. Charles Paget did well to publish this memorial of his father who wrote but little for publication during his life time, and the interest of the book to those who knew Sir George Paget, however slightly in life, will be increased by the characteristic portrait which faces the title-page.

DAWSON WILLIAMS.

NOTES ON BOOKS PRESENTED TO THE LIBRARY.

"Air, Water and Disinfectants," by C. M. AIKMAN, M.A., D.Sc., F.R.S.E. 128 pp., 8vo. *Society for Promoting Christian Knowledge. Price 1/-*

One of the Manuals of Health Series. Chapters dealing with Ventilation, Micro-organisms in Air and Water are included.

"Practical Guide to Sanitary Legislation, containing a synopsis of the Acts relating to Public Health and Local Government," by JOHN A. ANGELL, Assoc.M.Inst.C.E., Engineer and Surveyor Beckenham Urban District Council, and JOHN G. MORLEY, Assoc.M.Inst.C.E., Chief Assistant Borough Engineer, West Ham. 638 pp., 8vo. *Knight & Co. Price 12/-*

The aim of the authors in compiling this volume is to place in the hands of Officers and Members of Local Authorities, Architects and Students, a ready reference to the Sanitary provisions of the various Acts dealing with Public Health. This volume is, however, limited to the requirements of the Boro' Engineer and Surveyor's Departments, a second volume for the use of Medical Officers of Health and Sanitary Inspectors, &c., being in contemplation.

By-Laws with respect to New Streets and Buildings, Cleansing of Footways, Removal of Refuse and Snow, and the subjects on which a Local Authority may make By-Laws, together with an Index of nearly 50 pages are included.

"The Construction of Carriageways and Footways," by H. PERCY BOULNOIS, M.Inst.C.E., City Engineer, Liverpool. 143 pp., 8vo. *Biggs & Co. Price 5/-*

The various materials used and the different methods adopted in the construction of Carriageways and Footways are fully dealt with. Questions of cost, traffic, local conditions for obtaining suitable materials, rateable value of district and widths of street, together

with a detailed description of the various pavements are discussed. A tabulated return from eighty town and metropolitan districts on the subject is given.

"The London Building Act, 1894; also the By-Laws and Regulations," edited by BERNARD DICKSEE, District Surveyor for East Newington and part of St. George the Martyr. 226 pp., 8vo. *Edward Stanford. Price 5/-*

The Act is here dealt with in considerable detail with numerous notes and cross references and legal decisions, with diagrams illustrating heights of buildings, domestic buildings on new and old streets, courts within buildings, &c.

"Rearing and Feeding of Children," by THOMAS DUTTON, M.D. Univ. Durh., M.R.C.P. Edin., &c. 198 pp., 8vo. *H. Kimpton & Hirschfeld Bros. Price 2/-*

Intended primarily for the use of mothers and those who have the feeding and rearing of children. In addition to the chapters devoted to food, the subjects of Nursery Hygiene, clothing, exercise, sleep, and slight ailments are dealt with.

"Micro-organisms in Water: their Significance, Identification, and Removal," by PERCY FRANKLAND, PH.D., B.SC. Lond., F.R.S., and Mrs. PERCY FRANKLAND. 532 pp., 8vo. *Longmans, Green & Co. Price 16/-*

This work is specially designed for the use of those connected with the sanitary aspects of Water Supply, and the authors have endeavoured to present an account of the more important investigations which have been carried out in this department of bacteriology so as to be of service to the student and investigator as well as to Engineers and Medical Officers of Health. The more important general methods of bacteriological study are surveyed, describing minutely those specially applicable to the examination of water; and an account is given of the principal results attained by the use of these new bacteriological methods in the study of the different kinds of water. A special chapter is devoted to the action of light on micro-organisms in water and culture media. The appendix contains tabular description of the various micro-organisms found in water. There are many illustrations.

"Brodet acts tilberedning og forhandling af Ingjald," Dr. KJENNERUD, 111 pp., 8vo. *Haffner & Hille, Kristiania.*

"Bread: its Making and Sale from a Hygienic point of view."

The author deals with the subject in detail, taking into consideration the Grain, its Cleansing, Milling, Value of Bread Meal and Substitutes for Bread Meal, passing next to the Making of Bread,

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the Doughing Stage, Yeast, and different kinds of Bread are discussed, while the third part of the book is devoted to the Sanitation of Bakehouses; under this heading are discussed, the Bakeries in Sweden, and at Copenhagen, Stockholm, and London; the management of a Sanitary Bakehouse, and Official Control.

"Drainage Work and Sanitary Fittings," by WM. H. MAXWELL, Engineer's Office, Leyton Urban District Council. 74 pp., 8vo. *St. Bride's Press, Limited. Price 1/-*

To bring together in a condensed and handy form some of the main points in connection with the Construction, Examination and Testing of Drainage Works has been the author's design. There are numerous illustrations dealing with construction, and general arrangements. An Appendix contains Hydraulic Notes and formulæ, and Synopsis of Local Government By-Laws, &c., for New Buildings, and the Sections of the Public Health Act, 1875, which relate specially to Sewerage and Drainage.

"Hygiene," by Prof. J. LANE NOTTER, M.A., M.D.Dublin, and Surg-Capt. R. H. FIRTH, F.R.C.S. 374 pp., 8vo. *Longmans, Green & Co. Price 3/6*

Forming as it does one of Messrs. Longmans' Elementary Science Manuals, the authors have, as the preface states, endeavoured to deal with the many subjects which come within the title of the book in the simplest language. The work is intended as an Introductory Manual for the use of junior students preparatory to a more extended study of the subject, and is not to be regarded as a substitute for more advanced books on Hygiene.

"Text Book of Hygiene, a comprehensive Treatise on the Principles and Practice of Preventive Medicine from an American Standpoint," 3rd Edition by GEORGE H. ROHÉ, M.D. 553 pp., 8vo. *The F. A. Davis Company, Philadelphia, and F. J. Rebman. Price 17/6. $3.*

The chapter of "Quarantine" has been entirely rewritten by Surg.-Gen. W. Wyman and Dr. H. D. Geddings of the U.S. Marine Hospital Service, and that on Marine Hygiene thoroughly revised by Medical Director Albert L. Gitson, U.S. Navy. Chapters dealing with Air, Food, Water, Soil, &c., and other subjects which go to form a Manual of Hygiene will be found. The work is fully illustrated.

"An Elementary Text Book of Hygiene," by H. ROWLAND WAKEFIELD, Science Demonstrator to the Swansea School Board. 208 pp., 8vo. *Blackie & Son, Limited. Price 2/-*

Arranged specially to meet the requirements of the Examination in Hygiene of the Science and Art Department. The Appendix contains specimen Questions set at the Examinations from 1884 to 1892, together with the Syllabus of the Elementary stage of the subject.

"Handbook of Public Health and Demography," by EDWARD F. WILLOUGHBY, M.D.Lond., D.P.H.Camb. 509 pp., 8vo. *Macmillan & Co. Price 4/6*

Although under a different title, this is in fact a Third Edition, considerably enlarged, of Dr. Willoughby's "Principles of Hygiene." The book is written and arranged as a manual for the Examinations of the Science and Art Department, but the author has endeavoured to make the book equally adapted to the general reader. The chapter dealing with "Health in the House," is freely illustrated.

"The Sanitary Code of the Pentateuch," by the Rev. C. G. K. GILLESPIE. 96 pp. *Religious Tract Society. Price 2/-*

The author deals with the subject of Food, Uncleanness, Industrial Methods, Sanitary Precautions, Sanitary Inspection, Notification of Infectious Disease, and of Insanitary Condition and Disinfection, from which it is interesting to see that the broad outlines of such treatment as the latest investigations have shown to be most effective, even under conditions widely different, are to be found in the Mosaic system of Sanitary Law.

"Micro-organisms, with special reference to the Etiology of the Infective Diseases," by Dr. C. FLÜGGE, O.O. Professor and Director of the Hygienic Institute at Göttingen; translated from the second and thoroughly revised Edition of "Fermente und Mikroparasiten," by W. WATSON CHEYNE, M.B., Surgeon to King's College Hospital. 826 pp., 8vo, London, 1890. *Published by The New Sydenham Society.*

The form and vital characteristics of these micro-organisms are described in so far as they have a direct or indirect influence from a hygienic point of view. Dr. Flügge gives an historical sketch of our knowledge of ferments and parasites during the last few years, with a description and classification of micro-organisms from this standpoint. Chapter VI. is devoted to the distribution of the various micro-organisms in the air, soil, water, food, and the dwelling; and Chapter VII. to the conclusions come to with regard to the etiology and prophylaxis of the infective diseases. There are numerous illustrations, and 63 pages are devoted to a bibliography of the literature bearing on the subject.

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NOTES ON SANITATION ABROAD.

NEW SOUTH WALES.

By J. Ashburton Thompson, M.D., D.P.H.

Probably the circumstances under which organised government gradually becomes elaborated in a newly occupied country, are foreign to the experience of most readers of this Journal; it seems expedient, therefore, to begin a brief account of the sanitary state of New South Wales at the present date, by mentioning a few facts of settlement and increase from which imaginatively they may be reproduced. Summarily speaking the condition most important to keep in mind, is density—great extent of occupied area in relation to absolute smallness of population. For, while preventive medicine is one of the arts of civilisation, naturally, it is a late art; its occasion, and the best opportunity of exercising it, have been accurately indicated by Dr. Vivian Poore, in his epigrammatic sub-head "The Art of Living in Towns." Whence, during the present age, popular interest in sanitary science must remain merely critical, until high rates of density accumulated under unscientifically regulated conditions of civic life shall have given rise to persistently high death-rates, or at best can become fitfully practical only when some immediate convenience or profit is clearly visible.

New South Wales comprises about one-tenth of the continent of Australia, and contains 310,700 square miles. Its geographical boundaries are nearly indicated by the 29th and 36th parallels of South latitude, and by the 141st and 153rd meridians of East longitude: it has an eastern coast line to the Pacific of about 700 miles, running north and south.

This area is naturally divided into three well-marked zones. The coast zone has an area of 38,000 square miles; it is of a variable width not exceeding 100 miles. Narrow valleys and gorges lead up to the eastern face of the table-land zone, which stands at an average height of 3,000 feet; its width often extends to 100 miles, and it has an area of 85,000 square miles. The western face descends gradually to the great plain country of the interior, which measures about 188,000 square miles.

The following is a classification of the various sedimentary formations found in New South Wales:—

Palæozoic—Silurian.		
Devonian.		
Carboniferous.		
Permian.		
Mesozoic —Triassic.		
Jurassic.		
Cretaceous.		
Cainozoic Tertiary		Miocene. Pliocene.
Post Tertiary		Post Pliocene. Recent.

The palæozoic formation extends throughout almost the whole eastern portion of the colony; the upper Silurian rocks (sandstone, slate, limestone), principally occur on the western watershed of the main dividing range, and appear on the eastern watershed. To the cainozoic formation belongs the greater part of the central and western districts; cretaceous formations occupy the north-western part. There are also three distinct systems of coal-bearing rocks (lower carboniferous, permo-carboniferous, and mesozoic). Hawkesbury sandstone overlies the carboniferous formation of that part of the coast on which Sydney is built, and the Wianamatta series (beds of fine sedimentary deposits of argillaceous shales) extend round Sydney; they are of little thickness.

The climate must be spoken of in relation to the three zones just mentioned; it is one of the most temperate and uniform. The coastal zone has a temperature more mild than that of corresponding latitudes in the northern hemisphere, and, speaking generally the difference between mean summer and mean winter temperature may be taken as averaging not more than 24° F. Sydney, in lat. 33° 52′ S., has a mean temperature (thirty-three years) of 62°·9, which corresponds with those of Barcelona and Toulon; the mean summer temperature is 71°, of winter 54°, and the range 17° F. The highest shade temperature ever experienced was 106°·9, the lowest 35°·9; the greatest range was therefore 71°. Speaking generally, the yearly average temperature of the table-land is barely 56°; the mean summer temperature only reaches 69°, while the mean winter temperature is 46°—a range closely approximating to that on the Mediterranean coast of France. On the western plains the heats of summer are great, and in winter keen winds blow; but as the air is dry the conditions of life are thoroughly healthy, and the greatest summer heat does not appreciably tax either man or beast. The average rainfall of the coast-zone is 45 inches; on the table-land 31; and the fall decreases *to the west* with distance from the sea, from 21·6 to 12·5 inches;

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for the whole of the western area the mean fall does not exceed 17 inches. At Sydney the yearly mean rainfall (thirty-three years) is 49 inches, falling on 151 days; and the evaporation is nearly 38.

Forests extend over a great part of the area of the colony: except some comparatively small patches on the coast-zone and table-land; except also the great western plains which are covered with low scrub, salt-bush, or natural grasses. The varieties met with are chiefly species of the Eucalyptus tribe, and Melaleuca, Calistemon, and other genera of the order Myrtaceæ.

There are three distinct river systems—an eastern, a western, and a southern. Water drains away easily and rapidly; off the soil to the east, downwards into it to the west. There are no swamps of importance. In the coast-zone extensive alluvial flats are found towards the river-mouths; they are very fertile, and consequently well populated. Practically there is no malaria.

The first settlement in all Australasia was effected on the shores of Sydney harbour in 1778 by a party of 1030 persons. In New South Wales the population has increased since then as follows, according to official enumerations and censuses. The figures include coloured aliens, but exclude aboriginals who, as is well known, were never numerous enough to be of importance, and rapidly diminished in contact with the whites:—

Including Queensland & Victoria.

Year.	Persons.
1822	24,188
1823	28,333
1825	36,336
1833	60,794
1836	77,096
1841	130,856
1846	189,609

Including Queensland.

Year.	Persons.
1851	187,243
1856	266,189

New South Wales only.

Year.	Persons.
1861	350,860
1871	503,981
1881	778,690
1891	1,132,234

At the 1891 census the birthplaces of the population, which then numbered 1,132,234, were as follows: natives of New South Wales, 64·76 per cent.; of other Australasian colonies, 7·5 per cent.; other British-born subjects, 24·21 per cent.; and foreigners, 3·53. Among the latter, foreigners from the continent of Asia numbered 13,616; 99 per cent. of them were Chinese, of whom 109 only were females; and there were only 486 Kanakas (South Sea Islanders).

Males constituted 54 per cent. of the population. The age-distribution per thousand was as shown in the following table:

Census.	Enumerated Population.	Less Ages unspecified.	0—	5—	10—	15—	20—	25—	35—	45—	55—	65—	75—	Total.
1881	751,768	2416	148	132	118	101	100	148	115	75	39	18	6	1000
1891	1,132,234	1768	147	127	109	96	98	174	107	74	43	18	7	1000

Their local distribution was along the sea-board and in the fertile river-valleys of the coast-zone in greatest part. In the capital 34·26 of the total lived in an incorporated area of 142 square miles, the average density at the end of 1891 having 4·5 to the acre; but of the thirty-five municipal districts comprised in the area mentioned, three had densities of sixty-two, forty-seven, and forty-three; the city of Sydney, thirty-seven; four others, over twenty-five; while at the other end of the scale four had a density of one to every three acres. In 132 rural municipal districts lived 320,067 persons (there having been only eight towns besides the capital with populations above 5,000, which amounted in the aggregate to 122,974); while the remainder, or 412,897, lived on unincorporated lands, and under no form of local government.

During the decennium 1883-92, the average number of children to each marriage was 5·7; and the mean annual birth-rate for the same period was 36·4 (38·44 to 33·89); in the decennium 1882-91, of the total births 4·81 were illegitimate; still births are not registered. The average annual death-rate among persons during the twenty years 1873-92, was 15·12—males 16·25, females 13·77, per 1,000 of the mean population. The mean death-rate among persons during the same period in the city of Sydney, was 21·5 (31·65 to 15·82); in the suburbs of Sydney, 18·42 (24·47 to 12·53); in the city and suburbs together, 20·42 (26·81 to 13·59, in 1892), and in the country districts, being the rest of the colony, including towns, 13·06 (16·05 to 11·38). The mean infantile death-rate during the same term, was 163·6 (186·8, to 130·2 in 1892); in the city and suburbs taken together, being the metropolitan district; and 94 (103·7 to 74) in the country districts. The largest quarterly number of deaths is registered during the summer; usually during the first quarter of the year, sometimes during the last.

The following tables which I constructed for another purpose give some of the annual figures for the nineteen years, 1875 to 1893, on which the foregoing averages were in part struck, and additionally some information as to deaths ascribed to zymotic and diarrhœal diseases.

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New South Wales Metropolitan District—Recorded Rates.

Year.	Population estimated at Middle of Year.	Density.	Natural Increase per cent.	Birth-rate	Death-rate	Deaths under 1 year to 1000 Births.	Death-rate from Principal Zymotic Diseases per 10,000.								Zymotic Death-rate per 10,000.	Death-rate from Typhoid and Diarrhoeal Diseases per 10,000.	Percentage of Deaths, Typhoid and Diarrhoeal, to Total Deaths.
							Small-pox.	Measles.	Scarlet Fever.	Diphtheria and Croup.	Whooping Cough.	Enteric Fever.	Diarrhoeal Diseases.	Influenza.			
1875	161,126	(See text.)	1·09	37·67	26·80	176·93	...	16·32	13·65	6·14	0·12	7·19	28·06	...	60·51	32·25	12·43
1876	167,294		1·31	38·06	24·96	169·91	...	0·06	27·67	6·33	0·12	7·65	18·41	...	59·71	26·06	10·44
1877	176,419		1·88	37·66	18·82	156·20	0·23	...	0·45	6·17	1·02	5·66	18·59	...	32·32	24·43	12·97
1878	187,635		1·69	38·14	21·16	173·37	...	...	0·21	6·76	9·00	9·06	20·30	...	45·35	29·36	13·87
1879	200,609		1·97	39·18	19·46	153·41	...	0·05	0·10	5·38	0·45	5·73	19·88	...	32·50	25·62	13·16
1880	214,221		1·60	38·99	22·06	192·24	...	0·98	1·02	3·92	4·57	4·15	18·71	...	42·38	23·87	9·95
1881	227,731		2·00	39·14	19·11	162·02	0·75	0·61	0·39	1·97	2·10	4·08	15·63	...	25·55	19·71	10·31
1882	241,761		1·90	39·83	20·77	183·28	0·95	1·12	0·21	2·56	0·74	6·90	21·17	...	32·72	28·08	13·52
1883	258,514		2·10	39·80	18·75	163·26	...	0·89	0·37	5·02	0·31	6·57	16·24	...	29·43	22·82	12·16
1884	278,909		2·13	42·62	21·24	171·90	0·11	0·25	2·11	3·29	3·98	7·49	17·52	...	34·78	25·01	16·36
1885	285,090		2·02	43·02	22·77	186·86	0·03	0·07	2·17	4·81	0·84	7·82	20·84	0·70	37·60	28·66	12·58
1886	300,410		2·28	43·70	20·87	173·28	...	0·10	2·06	2·70	3·93	9·95	15·61	0·17	37·45	25·56	12·25
1887	316,550		2·49	42·39	17·52	140·83	0·41	1·39	1·39	5·47	1·36	6·03	11·18	...	26·53	17·21	9·83
1888	333,555		2·23	41·09	18·76	152·04	0·08	3·69	2·13	6·05	0·12	5·46	12·86	...	31·54	18·32	9·76
1889	351,475		1·99	37·97	18·03	172·44	...	0·11	0·68	7·80	5·97	5·95	13·23	0·86	34·17	19·18	10·63
1890	370,355		2·14	36·53	15·10	134·75	...	0·05	0·92	5·16	2·20	3·86	8·45	0·51	22·14	12·31	8·16
1891	389,655		1·95	35·95	16·48	148·13	...	...	0·51	5·83	2·51	2·80	8·47	6·21	27·13	11·27	6·84
1892	405,490		2·11	34·70	13·59	130·21	0·02	0·05	1·06	3·40	2·54	1·07	7·32	0·49	19·21	9·27	6·84
1893	416,370		1·79	33·52	15·57	146·75	...	9·10	3·58	3·63	0·93	1·78	8·12	0·43	30·21	9·40	6·35

New South Wales Country Districts—Recorded Rates.

Year.	Population estimated at Middle of year	Density.	Natural Increase per cent.	Birth-rate.	Death-rate.	Deaths under 1 year to 1000 Births.	Death-rate from Principal Zymotic Diseases per 10,000.								Zymotic Death rate per 10,000.	Death-rate from Diarrhoeal Diseases and Enteric Fever per 10,000.	Percentage of Deaths from Diarrhoeal Diseases and Enteric Fever to Total Deaths.
							Small pox.	Measles.	Scarlet Fever.	Diphtheria and Croup.	Whooping Cough.	Enteric Fever.	Diarrhoeal Diseases.	Influenza.			
1875	423,493		2·36	38·66	15·23	98·49	...	11·57	1·93	4·55	2.40	4·29	10·38	...	35·13	14·68	9·64
1876	436,944		2·26	38·74	16·05	91·37	...	0·78	14·73	5·90	0·34	6·24	8·37	...	36·48	14·62	9·10
1877	452,524		2·35	38·02	14·46	101·53	...	0·04	1·90	6·96	0·29	6·07	10·93	...	26·23	17·01	11·75
1878	470,162		2·42	38·64	14·44	102·74	...	0·02	0·40	8·03	4·21	5·76	11·69	...	30·13	17·46	12·08
1879	490,064		2·60	38·91	12·82	88·08	...	0·04	0·22	7·81	2·44	3·06	7·15	...	20·77	10·24	7·98
1880	511,454		2·63	38·72	12·33	80·47	...	1·09	0·55	4·00	0·66	2·91	6·43	...	15·66	9·36	12·70
1881	532,560		2·42	37·70	13·48	94·51	...	1·38	0·49	3·96	2·02	3·24	8·75	...	19·88	11·9[illegible]	9·89
1882	553,600		2·22	36·29	14·09	106·21	...	0·13	0·61	5·17	1·64	5·11	10·16	...	22·83	15·28	10·84
1883	575,774	(See text.)	2·37	36·45	12·68	90·90	...	0·42	0·62	5·80	0·76	3·94	7·46	...	19·19	11·41	15·62
1884	601,817		2·28	36·67	13·78	101·65	...	0·65	0·28	3·87	1·49	5·10	8·24	...	22·16	13·34	9·68
1885	642,185		2·18	35·47	13·69	101·15	...	0·12	1·01	6·93	1·40	4·36	7·01	1·15	20·40	11·37	8·31
1886	669,045		2·22	34·61	12·43	101·92	...	0·04	0·39	2·61	1·86	4·36	7·31	0·36	17·79	11·67	9·39
1887	688,285		2·31	34·60	11·48	86·29	...	0·10	0·44	4·55	2·35	3·43	6·03	0·25	16·53	9·46	8·24
1888	702,150		2·37	35·35	11·61	83·12	...	1·35	0·57	3·10	0·44	3·59	6·31	0·20	15·54	9·90	8·53
1889	714,975		2·17	33·50	11·83	98·62	...	0·12	0·56	3·08	0·43	4·76	8·67	0·20	18·13	13·43	11·35
1890	731,485		2·36	34·77	11·79	88·44	...	0·04	0·45	6·26	2·31	2·23	4·46	1·45	16·43	6·69	5·67
1891	753,925		2·07	33·76	13·09	102·79	...	0·13	0·27	5·65	2·16	2·12	5·37	0·89	24·07	7·49	5·73
1892	775,985		2·20	33·47	11·47	92·91	...	...	0·34	4·12	1·55	3·19	5·21	1·79	16·02	8·40	7·83
1893	794,140		2·12	33·23	12·01	98·23	...	4·34	0·40	5·30	1·74	1·88	5·97	0·96	20·37	7·80	6·49

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In 1892, a life-table was constructed by Mr. T. A. Coghlan, Government Statistician. The ages assumed were those at the census of 1891; Mr. Woolhouse's system of adjustment being used. The deaths were those which occurred during the twelve months preceding and the twelve months following that census. The population dealt with (1,123,954), was composed of two-thirds native born, one-third British or foreign born; but of all aged above 16, about half belonged to the latter category. The influence of native birth could not be examined; but admixture of not Australian born was found not to have improved expectation at the ages where their proportion was large enough to have importance. The table showed that the expectation was greater than by the English life-table of Dr. Ogle, for males at every year up to 84—at birth by 8·25, at five years by 4·03, at ten years by 3·29, at thirty by 2·2, and at sixty by ·46; and for females at every year up to 64.

From the foregoing *resumé* of broad facts to a description of the health-service which exists in this colony is a natural transition. And first of all it had better be pointed out that there are few laws, and there is no organisation such as the readers of this Journal justly have in mind. There is no public health Act. A former President of the Board of Health did indeed persuade the Government to adopt a public health Bill in 1886: the drafting of this measure was entrusted to the present writer in conjunction with a former Attorney-general; and it was introduced in the Upper Chamber on behalf of the Government by the Right Hon. W. B. Dalley, P.C., simultaneously with a Local Government Bill in the Lower Chamber. But both measures were interrupted by prorogation, and the former has never been reintroduced.

Until 1881 there was no central health authority. In that year a Board of Health was called into existence by the Infectious Diseases Supervision Act, which was passed during a small epidemic of small-pox, to deal with that infectious disease alone, and which extended powers already possessed under the maritime Quarantine Act to apply to persons and places on shore. A Board appointed under these circumstances could not represent any property-interest; its usefulness would therefore be contingent on its members each possessing special knowledge of some subject directly bearing on public health. But the enactment which created it had not been deliberately framed to found a health department, but merely to create a body which by its respectability, and (from its including some members of the medical profession) its knowledge, should relieve the Government for the future of the discredit which had accrued to it in its efforts to deal with the outbreak referred to. This false step

—for the term "Board of Health" imports in the public mind all that is commonly understood by it, and yet in this case indicates something else—has never been retrieved. The President, the Under-Secretary for finance and trade, the Inspector-General of Police, and the Mayor of the city of Sydney, are *ex officio* members; and four or five medical men accustomed to the general views of health which medical practice induces, together with two or three laymen accustomed to affairs, compose the remainder. The Presidents, of whom there have now been four, have always been chosen from among the medical profession; but they have also been already fully occupied with the business of their lives (which has never been concerned with public health) to which their official business, in consequence, has necessarily been secondary. This body has statutory authority under the Act already mentioned, the Dairies Supervision Act (1886), the Leprosy Act (1890), the Diseased Animals and Meat Act (1892), the Amending Quarantine Act (which put the old office of Health Officer in commission with the Board), and the Noxious Trades and Cattle-slaughtering Act (1894). Its officers are a Chief Medical Inspector, a Bacteriologist (Dr. F. Tidswell), a Boarding Medical Officer (quarantine), three Veterinary Surgeons, Inspectors, an Analyst, and the usual clerical staff: all of these are civil servants whose whole time is occupied by their official duty. It was incorporated in 1894; it is the repositary of such authority as has been directly conferred upon it by the laws mentioned; it directs all that shall be done; it meets once a week, and then considers the written representations of facts as they appear to the officers who furnish them; none of the latter can take any initiative. Lastly, it stands in official relation with no other department of Government than the Treasury, of which it forms an office or sub-department, and with the Chief Secretary's in relation to certain of the Acts mentioned.

The various departments or sub-departments of Government, however, necessarily deal with many matters directly touching the public health; they do so each independently of all the others and of the Board. Water and sewers, vital statistics, registration of births and deaths, vaccination, the hygiene of schools, municipal local government (with slight exceptions to be mentioned), the hygiene of public works, the administration of justice (including prisons), the administration of charitable institutions, are all managed without there being any formal bond between them, and without recognition of their common interest in the one object they all subserve. As departments of the same Government they have the means of communicating with each other, but are under no obligation to communicate.

Perhaps enough has now been said on this fundamental topic; not too much, is to be hoped—the indweller being always likely to run into unnecessary detail when he tries to inform outlanders. Yet a saving clause must be added; part of the relief of the destitute sick, public vaccination, and the Government medical officers, are under control of an officer called the medical adviser to the Government who has no statutory powers. Hitherto he has been also the President of the Board of Health; the latter body, therefore, has opportunity of procuring information on those topics, but cannot discuss them.

Local government is exclusively municipal. Corporations draft their own by-laws, which are gazetted after being approved by the law-officers of the Crown only. The Municipalities Act (1867) conferred some of the usual minor powers necessary for municipal care of the public health; but the duty of appointing inspectors of nuisances was imposed on them only by the Nuisances Prevention Act (1875) which dealt exclusively with conservancy. These officers are poorly paid. They are very useful; but they are entirely at the mercy of their councils, and very rarely, indeed, have any particular qualification. The councils are under no control in respect of health matters, except as regards one or two of the Acts already mentioned under which they are responsible to the Board of Health, and if they fail to execute their powers or to carry out orders of the Board, may be superseded. On the other hand, they often seek advice from the Board, and often act upon it.

In every populous centre a Government medical officer and public vaccinator is appointed; he stands in no official relation to the Board of Health, though the medical adviser to whom he reports occasionally, often communicates his statements to it. These officers are not paid, and have no defined duties. They are remunerated for their occasional communications by a first claim on all police and Government work required in their districts (which are not defined), and are paid by fee for special reports. They are not officially related to municipal councils. They thus constitute at most the rudiment of an intelligence department; and therefore in connection with them must be mentioned the police, who are brought into informal communication with the Board by its member the Inspector-General. These men constitute a most valuable part of the intelligence branch, and in unincorporated districts an important executive body.

Public vaccination is provided, but there is no compulsory Act; the Board of Health has, of course, often urged the introduction of one, but thus far unsuccessfully. An excuse for not touching this matter has been found in the sitting of

the Royal Commission on Vaccination; the delay in issuing the final report of this body consequently has taken ill-effect far outside England. There are three public vaccinators for Sydney (now a population of more than 400,000). During the year 1893 only 838 vaccinations were done in Sydney, and only 1,368 in all the rest of the colony; returns were received from sixteen country districts reporting 1,368 vaccinations, while from eighty-nine country districts no reports at all were received. The mean proportion of vaccinations to 1,000 births during the thirty-three years 1861 to 1893 for the whole colony was 290; and the same proportion was as follows in each of the ten years 1884 to 1893:—

1884	207	1889	64
1885	63	1890	68
1886	48	1891	39
1887	86	1892	98
1888	56	1893	54

There is not, of course, any inspection of results. To these must be added all vaccinations done privately, of which no account is kept; but probably the total is quite small. Since on any alarm of small-pox the number of public vaccinations greatly rises, the neglect which the foregoing figures indicate must be ascribed to carelessness rather than to any settled public feeling or opinion. The higher proportion shown in 1884 was due to such alarm. Lymph is not cultivated in this colony; calf-lymph is imported from an establishment in New Zealand.

Infectious diseases are under no control except small-pox, and (as to place) except ships and dairy premises. Notification of cases and of suspected cases of small-pox is compulsory on householders and medical men under a heavy penalty for neglect; but no fee is paid to the latter for their reports. The farther proceedings are equally arbitrary. The reported case is visited by the Chief Medical Inspector, from whom there is practically no appeal; if he declares it a case of small-pox, he forthwith places the house and all persons in quarantine under the police, vaccinates, instructs the police to secure members out of doors or fled, transmits all persons to the maritime quarantine station, and hands the house over to the disinfecting staff. The sick are detained until he declares them clean, the suspected for twenty-one days. Compensation is paid for goods destroyed or injured during disinfection, and for house rent; in addition to which houses are restored to habitable condition if that has been interfered with by disinfection, &c. All goods are transmitted to the quarantine

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station with, or immediately after, their owners who appraise them, in company with the Superintendent of quarantine; they are then disinfected. This proceeding has on several occasions within my personal experience been perfectly successful, and has never failed; but it would necessarily break down for want of accommodation if more than (say) sixty or seventy households became infected within twenty-one days, and it is fortunate that in country districts only isolated cases have occurred. This quarantine, and the success with which it has been applied since 1884, is probably an obstacle in the way of legislation for compulsory vaccination; yet experience shows that isolation and quarantine could not be dispensed with were the latter possessed. But, then, isolation would be seen in its proper relation, as a supplement to public vaccination; and it is this view which the successes mentioned obstruct for the public. Under the Dairies Act, that is as regards places, all infectious diseases are compulsorily notifiable under penalties for neglect, but, as before, no fee is paid for medical certificates. Leprosy also (which is here regarded as a virulently contagious disease) is compulsorily notifiable, with penalties but without reward. It is not worth while to say much about maritime quarantine, nor yet to leave room for the usual misunderstanding regarding it. The term is retained because it is universally understood; the thing it anciently and strictly indicated is unknown. It here applies to a proceeding which is the same as that used ashore in England in the case of the poorer dwellings or lodging places when circumstances render it possible to isolate not only the sick but the suspected as well. It applies only to ships which actually have on board, or lately during the voyage have carried, cases of infectious disease. There is nothing more than that in Australian maritime quarantine. Ships are held only until they have been disinfected. Persons are never quarantined on board their ships. All hands are transferred to quarters on shore, which most of them find luxurious, and which (as regards Sydney, at all events) are most beautifully situated.

Public hospitals all over the Colony are required to furnish some small accommodation for cases of infectious disease; but there is no isolation hospital anywhere. A diphtheria branch is attached to the hospital for sick children at Sydney, and at the Coast Hospital (a government institution for the acute cases occurring among the destitute) cases of infectious disease are received from all classes of the community. The quarters, though useful, are make-shift, and the institution is nine miles from Sydney, and three miles from the nearest suburb. The only disinfecting apparatuses in the Colony are a Lyon's dis-

infector at the quarantine station, and another at the Coast Hospital. There is no special organisation for disinfection of houses or goods, except in the case of small-pox; and the quarantine staff which performs that duty is available for other classes of the same work only on special application, and when the maritime quarantine establishment to which they belong happens not to be under the yellow flag. There is no municipal provision of this kind anywhere.

The reader is now aware that as yet there is no scientific management of the public health in New South Wales, where the first rudiments of public health service can alone be described—spontaneously evolved under the stimulus of immediate fear or of immediate convenience, and consequently not promising much for the future. But it would be wrong to leave an impression that nothing useful has been done. The Board of Health commands public respect; the office described has grown up under its care, where before there was absolutely nothing at all of the kind. Besides this, the introduction of the Acts mentioned in direct connection with it above, was due to its efforts, and these, within their limited sphere, have been judiciously and profitably executed by it. This being so, the question arises, how is it that public health matters have not long ago been placed on a sound basis, such as would allow of all the development which in future will certainly be required? The answer to it would have interest even for strangers; but neither is space unlimited, nor is it convenient at all times to discuss political details publicly. But it may be said in general that a just appreciation of these matters is wanting even among the educated public; and it may be asked (also in general) whether a new and growing people, who are constantly being congratulated on the comparatively low death-rates which prevail among them, can be expected to ask for laws which in their operation necessarily must affect private interests? To the sanitarian, the causes which concur to keep those rates low (in as far as they are low) are transparent; and that they will disappear with continued prosperity is in their nature; but all this is not evident, at all events to the public concerned. I propose to conclude, then, by describing water-supply and sewerage; but first vital statistics must be briefly referred to, on which all else (for those are largely matters of convenience) in this connection turns.

The Registration Act (1855) followed the Act 1837 closely; but it allowed thirty days to elapse before failure to register deaths became penal, and sixty in the case of births. This allowance was, doubtless, necessary at the date mentioned, but *now, when* every village has its telegraph station, and its coach-

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line to the nearest railway, it cannot be required. Probably nine-tenths of the population are now within a few miles of a District-Registrar. The records are kept by the Registrar-General, but they are abstracted by the Government Statistician. These two officers are so little in organised communication, that a short time ago the boundaries of important registration districts were altered long before the latter became aware of it. The Statistician issues monthly accounts and quarterly accounts for Sydney. Institution-deaths there constitute from 10 to 15 per cent. of the total; they are not distributed. He also issues yearly abstracts for the country districts: no intermediate information is available for them. Farther, the country districts comprise all the rest of the Colony; under that heading urban and rural populations are massed. There are no other means of ascertaining the state of particular towns than by abstracting the local record in the local office; and from the extent of country which each district comprises, a useful abstract concerning the town only can scarcely be made but by a local resident. The Board of Health receives no information, either from central or local Registries; it stands to them in the same relation as the general public. Excellent as the Statistician's returns are—quite remarkable for extent, variety, and accuracy, indeed—they are thus practically useless for the detail purposes of sanitation. In short, the use of vital statistics as a gauge is more or less generally understood; but their use as the sole basis of successful and economical sanitation, seems to be not so much as suspected.

Since 1878, country towns to the number of forty-one, representing a total population of very nearly 205,000, have had public water-supplies. Five were constructed by municipalities, one by a private company, the remainder by the Government; the latter, on completion, were handed over to councils under bonds for repayment of capital and interest at the end of a long term, lately extended to one hundred years. The cost of twenty-five of these (particulars of the remainder not being available) was £833,089. The water is usually drawn from rivers or tributary streams; it is from underground drift in four cases; and from an artesian well in one. The water is filtered only at four places, and that not constantly. No detail information as to filtration is available. Samples are occasionally examined by the analyst, but I am not aware that any systematic watch is maintained. For the most part the streams from which water is taken drain stocked but (practically) uninhabited country. The supply of water to the metropolitan district has been, since the third quarter of 1887, from a catchment area of 354 square miles of sandstone country, situated

about sixty miles from Sydney. It carries only a short brushwood, no inhabited dwellings, and is not cultivated. The water is drawn from three rivers fed from this watershed on the eastern side of the coast range, which have been suitably dammed and united; and it travels by twelve miles of tunnels and twenty-eight miles of open aqueduct to a reservoir at Prospect. This has a water-surface when full of 1,261 acres, and holds 10,812,313,000 gallons, of which 6,744,343,000 are available by gravitation. It was formed by throwing a dam 7,300 feet long, rising to 84 feet high, across a valley. Thence the water flows in an open canal, five miles long, to the pipe-head basin, and thence another five miles by pipe to a balance reservoir of 100 million gallons capacity. Therefrom it gravitates by a double pipe-line to the main pumping station within the city of Sydney, 141 feet above high-water mark. At the balance reservoir is a screening tank, the screens being of 840 mesh copper-wire gauze. From the reservoir at the main pumping-station a considerable part of the population is supplied by gravitation; here also pumping for the other part begins. Without going into farther details of works, pumping-stations, &c., it may be noted that during 1893 the number of houses supplied was 81,288, the estimated population 390,182, the consumption per head was 32 gallons per day; 50 per cent. of the water had to be raised by pumping; the capital debt showed a little under three-and-a-half millions sterling at the end of the year, the revenue thereon was 4·61 per cent., and the interest on the capital debt after paying expenses was 3·52 per cent. The service is constant. This water is analysed monthly by the Government Analyst, samples being taken at the four points mentioned below; the Table gives the average results of twelve such analyses in each case, and the extreme variations are so small that it is not worth while to mention them:—

	Grains per Gallon.				Parts per Million.			
	T. S. R. dried at 220°.	Cl. as Chlorides.	N. as Nitrates and Nitrites.	Phosphites from Animal Impurity.	Free Ammonia.	Album. Ammonia.	O. absorbed 15 min.	O. absorbed 8 hours.
Main Pumping Station	6·63	2·4	None	None	·01	·07	·28	·62
Service-pipe, Randwick (suburb).	6·51	2·4	"	"	·00	·07	·28	·59
Prospect Reservoir, near inlet ...	6·40	2·4	"	"	·01	·07	·29	·68
Basin at head of Canal below Prospect Reservoir	6·60	2·4	"	"	·01	·07	·28	·67

The charge for water supplied for domestic purposes otherwise

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than by measure is for houses assessed at £20, 10*s*. a year; above, and up to £300, 6*d*. in the pound; above, and up to £700, 5*d*.; and so forth, until the charge is reduced to 2*d*. in the pound of assessed value, when the latter is above £4000 per annum. When supplied by meter the charge is 1*s*. a thousand gallons up to 20 million a year, then 9*d*. There are also fixed charges for water delivered for other than domestic purposes otherwise than by measure. Weak points in the scheme are the five miles of open canal between Prospect and the pipe-head basin (on account of the cultivated and populated country through which it passes), and 14,232 ball hydrants.

For the present there are no sewers outside the Metropolitan District. The City of Sydney (4·31 square miles, 18,000 houses, 109,000 inhabitants in 1891, and steadily diminishing) began to be sewered about 1855, by underground channels of primitive construction, which discharged into the comparatively still waters of the land-locked harbour. Usually water-closets were external fittings, and as far as my observation goes, it must always have been the custom to cause internal fittings to discharge over yard gulleys. Hence the dangerous scheme was not productive of much harm, and was a great advance in point of convenience. These sewers have been intercepted by the new sewers to be described; parts have been reconstructed, repaired, &c., &c., but they still remain offensive. In 1880 schemes for sewering two areas were decided upon. The northern was designed to serve an area of eight and a half square miles, calculated to carry a prospective population of 217,000 persons. It is described as "partially separate" (which I prefer, for obvious enough reasons, to call "partially combined"); but no particulars are available; however, as the outfall sewer is 6 ft. 10 in. by 5 ft. 10 in. in the course of a run of about two and a half miles, increases to 8 ft. by 7 ft. 6 in., and is provided with a storm-water overflow, it may be regarded as combined. The outfall pierces a cliff 4 ft. below high-water mark, and discharges into the very deep and constantly agitated waters of the Pacific, at a point where a current strikes the coast at the angle of its boomerang course. The southern system was designed to drain an area of one and a half square miles, and to serve a prospective population of 50,500; the outfall sewer is circular, 5 ft. 6 in. in diameter, provided with overflow chambers and valves, and discharges on to a bed of pure sand in Botany Bay, at the mouth of Cook's river, the average level of which is 9 ft. above high-water mark; this is laid out on one side of the main-carrier, in filter beds; on the other, in irrigation beds. The latter are cultivated, the former are occasionally cropped. The sewage first passes through screen-

ing-tanks only, and the sludge therefrom is carried to the sand and "used as manure." An average analysis of the effluent is the following:—

Appearance.	Grains per Gallon.				Parts per Million.			
	Cl. as Chlorides.	Phosphites from Animal Impurity.	N. as Nitrates and Nitrites.	T. S. R.	Free Ammonia.	Album. Ammonia.	O. absorbed 15 min.	O. absorbed 8 hours.
Brown and turbid ...	7·5	...	...	29·54	8·	·5	5·8	12·

In 1888 a third scheme was approved, and now is approaching completion, designed to drain an area of twenty-two square miles carrying a prospective population of half a million. The outfall sewers consist of three circular conduits each 6 feet in diameter; these end in a chamber into which five main intercepting sewers discharge. From 10 to 16 per cent of the rainfall is to be admitted to this system; and the sewage will discharge on the large area of sand already mentioned, of which the average height above high water mark will then be 6 feet. About 29 per cent. of the prospective flow will require pumping, but the lift will be quite small. When these works are completed, the sewerage of Sydney will be provided for, and in respect of a population which can scarcely accumulate for many years.

At the end of 1893 the number of houses sewered was 36,062, the estimated population served was 173,097, the total length of sewers was 182·34 miles (in addition to which there were nine miles of storm-water drains, mostly open channels). The capital debt on account of sewers was £1,691,462, the percentage of revenue thereon 5·53, and the interest on capital debt after paying expenses 3·93, notwithstanding some heavy charges for works at that date not producing any revenue. And by way of marking progress it may be added that the number of houses sewered was 22,765 (population served 109,272) in 1890; but of this and other totals 18,000 were city houses imperfectly connected with the old sewers within the City for many years before.

Water-supply and sewerage are under control of the Metropolitan Board of Water-Supply and Sewerage; there is a similar Board for the Hunter River district, which for the present has water under its control only, although a great deal of preliminary work connected with sewers has been done under its direction. The former Board stands in no relation with *the Board* of Health; and it not only controls the construction

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and administration of sewers, but also house sanitation; and reviews the state of the public health during the year, in as far as it has been, in its opinion, influenced by its works. All this is confusing and unintelligent; but the faults are not due strictly to either Board, but to the chaotic state of sanitary administration in the colony in general. If the Sewerage Board did not undertake this work it would certainly not be done at all; the arrangement is, therefore, advantageous as far as it goes.

The by-laws and regulations in respect of sewerage are well drafted. All new work must be executed by plumbers licensed by the Board; the Technical College has large plumbing classes where, no doubt, correct instruction is imparted; no work may be covered until it has been passed by the Board's own inspectors; and no plumber's bill need be paid until the plumber can produce the Board's certificate that the work has been done in accordance with its requirements. All new work is tested hydrostatically. Premises connected with sewers before the Board came into existence, may be re-drained by the Board at the owner's expense if their attention is drawn to them; and no alterations may be made, nor any repairs in existent fittings, without giving notice to the Board. Within the city, however (where old and faulty connections are chiefly met with), systematic house-inspection is carried on by the Board, and 526 houses had their drains reconstructed or repaired under compulsory orders during 1893.

A few flush-tanks have been lately put in on some dead-ends and low-lying branches. Ventilation, as designed, was by open manhole grids. A system is gradually being extended of ventilating in part by down-cast and up-cast shafts, and in part by water-sprays, which now applies to about seventy miles of sewer.

IRRIGATION IN NORTHERN INDIA, A PROTECTION AGAINST FAMINE,

AND ITS PAST AND PRESENT EFFECT ON THE HEALTH OF THE PEOPLE,

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IT is very difficult within the limits of one paper, to give an idea of the extent to which irrigation is practised in India, but the author trusts that it will be left to him to select the points by which it is possible, within such a limited compass, to illustrate the bad and good effects of canal irrigation in the Punjab and Northern India generally. This paper may with advantage be divided into three parts:—

1. Protection against famine.
2. How irrigation is injurious to health.
3. How irrigation is beneficial to health.

But before these points are discussed, it will be necessary to explain what irrigation is, and how it was, and is practised. A village is a community in itself, and has an area of from 1000 acres to 3000 acres. Within its walls there are carpenters, blacksmiths, leather workers, potters, and artisans in general. All receive a portion of each year's harvest to repay them for any work done for the members of the community. No money passes for wages, unless they are employed by outsiders for work outside the village. It is therefore to the interest of all that the village should prosper, and any matter connected with the community in general, is discussed by all assembled in conclave, in the village meeting house. Any decision given by the authorities is freely discussed, and its probable effect on the village canvassed. There are two harvests, one which comes to maturity in the hot weather, viz., March to September, and one in the cold weather, October to February; sugar-cane is the only crop which remains in the ground for twelve months. None of the crops will come to maturity, unless an artificial supply of water is given, this can be done by wells, or by an *irrigation* canal; the latter is of course the cheaper as the water

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flows by gravitation on to the soil, carrying with it the fertilizing elements of silt in solution. The former has all to be lifted by various inefficient methods, but at the same time suited to the intelligence of the ignorant cultivator, and such machines as they use *e.g.*, the Persian wheel, can be easily repaired by the village carpenter. Each cultivator owns or takes on rent some land, the artisans receiving a share of each year's produce to repay them for any work done for the cultivator. Artisans do not engage in agricultural pursuits. There is in each village a large common on which any member of the village may graze his cattle free, this is seldom irrigated, and in future such irrigation will be prohibited, so as to enable the requisite number of cattle to be reared and fed for the use of the agricultural classes. All field work is done by bullocks, horses being never used for the purpose. Village life is a simple life, paternal treatment, not harsh laws, is necessary, nothing outside the village interests the simple peasant; his land, his bullocks, his home, are all in all to him.

It will thus be easily understood how close is the tie between the canal engineer living alone in the jungle, and the irrigating class all around him, and how they come to him in all their joys and sorrows. A kind and sympathetic nature placed in such surroundings, gains an insight into the life of this class of people, denied to every one else. Their health, their wealth, their food, are his property; just as much as that of the peasant. Irrigation has been practised from time immemorial in the East, but the old native methods have generally been abandoned by the Irrigation Department of the Government of India.

The basis of all artificial watering, was that of well-irrigation, then came the Inundation Canal system, giving an intermittent supply, and finally the Perennial Canal system, which latter is a constant system, and never attempted by any Native Ruler in the past.

Irrigation from wells is still extensively practised in the country between the Chehab and the Indus, called locally the Sind Sagar Doab, the water is raised by means of Persian wheels, the motive power being bullocks. Each well, with four pairs of these animals, working in turn as a pair, night and day, will supply water sufficient for any crop except rice, indigo, sugar-cane, providing the area does not exceed three to five acres. Inundation canals are confined to the country between the Sutlej and the Suleiman Mountains, they are in flow as long as the rivers are in flood—generally five months—but they are only in use during the hot-weather harvest. Those in existence were made by the Sikh rulers, by forced

labour, and are now cleared out and repaired by labour supplied by the irrigators, instead of by means of a money payment for water received. A Perennial Canal varies from 300 feet to 3 feet in bed width, the depth of water from 13 feet to 1½ feet, and the discharge per second from 5,000 cubic feet to 3 cubic feet.

In order to realize as to what this means, I will mention that the discharge of the River Thames at Teddington is, on an average, 2,370 cubic feet per sec., and the length from source to sea is 205 miles, while the Sirhind Canal from the River Sutlej discharges 5,000 cubic feet per sec., will irrigate 750,000 acres, and has a length, with all its branches, of 2,900 miles. This is one system only. To take another system, the Chenab Canal at present part finished, will command an area of 3,000,000 acres; and as the country through which it passes is at present for the most part unpopulated, this has all to be parcelled out into allotments and colonized before irrigation can be practised. The colonists will be drawn from districts already over-populated, and for whom in their own district, the food supply will soon be insufficient; by this means, it is hoped, that famine will be of rare occurrence in the future. The general opinion of medical officers in the East is, that insufficient food and clothing is the cause of many avoidable deaths all over the country; and it is to reduce this death-rate and the proneness to contracting disease, that the Irrigation Department is straining every nerve to increase the food supply; and if it is taken into consideration that at the last census the population of India had increased 32,000,000 in ten years, it will be evident, that if this rate is maintained in the next decade, the food supply must be increased in a like proportion, if the health of the people is to be preserved. Philanthropists have suggested emigration; but what is the use of it, when there are large tracts of country at present unpopulated, which, on the construction of a canal, will be converted into a garden; the soil of the Punjab only wants water to make it produce almost any crop suitable to a tropical country; and there are thousands of the agricultural class who will willingly leave their present over-populated abodes, to secure an allotment in a new country. All that is wanted is money annually to build canals.

Previous to the year 1876 there was always a liability to famine, and this seemingly occurred at apparently fixed periods (at least so the author is informed), partly due to insufficient food production, partly to insufficient means of transporting food from one district to another. To combat this, it is necessary in the first instance, to make more canals, and in the second more railways.

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Experiments were made of combining navigation and irrigation in one canal, but these have not proved a success, the ordinary irrigation canal will be sufficient for any boat traffic likely to come on it for many years.

It is with the former that this paper deals. Those who have witnessed a famine can never possibly forget it. Such scenes as dead bodies rotting by the roadside being very common, these are the remains of travellers overcome by weakness. Other scenes, as vultures, jackals, pariah dogs, and the like preying upon the bodies of the victims of the famine, are too loathsome to enlarge upon in detail. When famine overtook a district, the dead had in many cases no one to look after them, the survivors being usually too weak from want of food to do anything more than what was absolutely necessary for their own safety. Every available Government servant was employed on famine duty, *i.e.*, arranging for the transport of supplies from more favoured districts, forming relief camps, laying out work for those who could do work, and paying them a daily wage sufficient to buy their daily food. As the land produces nothing in a famine year, all the agricultural class are out of work, and as each village supports its own poor (there being no Poor Law in India), all these have to be fed somehow or other. Canal engineers are specially suited to this work, hence they get plenty of it. The above is only an outline account of famine work, still it is necessary to go a little into it to enable the contents of this paper to be understood, and also to explain what has been done to prevent a recurrence of anything like the last famine, the effects of which were plainly visible when the author landed in India in 1877. There are two systems of irrigation, the sanitary and the insanitary, and of both of these the author has had personal experience. It was due to the latter that his health broke down necessitating his leaving the service of the Government of India; it is of course needless to add that the former system has now been worked out to perfection, but a description of both will be given.

It is to be hoped that the author has made it clear in what sense irrigation is a protection against famine, it will be now shown how it is injurious to health. The next portion of this paper will deal with irrigation on an insanitary system.

When the Indian Empire was taken over by the British nation, there were many canals in existence, but these were all constructed on the cheapest plan, and as the author will endeavour to show, the most insanitary; for, in order to make a canal cheaply, the excavation had to be reduced to a minimum; the channel thus followed the bottom of the valley.

The crossings were all composed of rough timber and brush-

wood, cut free of cost from the surrounding jungles, their total cost was simply the cost of the labour in erection. They were only made in the narrowest places, and were of such a flimsy construction, that they were invariably washed down by the first freshet, and they were left in that condition, until the channel ran dry in the winter, when they were erected for the next year. One of the first canals made in Northern India was the Western Jumna Canal, 450 miles in length.

The projector was the Emperor, Ali Murdan Khan, he employed forced labour at times; but on the whole the means employed were as follows:—

The head was formed by throwing an embankment across a narrow creek of the River Jumna, near the lower ranges of the Himalayas; and as long as the river rose slowly this stood the force of the water, but on the appearance of the first flood, the bank gave way, and the canal was emptied. It remained in this condition until the fall of the river in winter allowed them to get to work again, and make up the bank for the ensuing summer. The water passed down an old abandoned river channel, and from this point excavation commenced. It may be remarked here, that all rivers in Northern India are at their highest in June, July and August, and at their lowest in November, December and January; this may seem paradoxical, but as they are all supplied by the melting of the snows in the mountains which commences in May, it will be readily understood that the maximum supply will pass down about that time. Whereas in the winter the snow remains unthawed, and hence there is a very small flow of water down the mountain side, until the sunshine regains its full power.

To take up the subject again, the canal followed an old abandoned channel of the Jumna, this extended approximately to a distance of thirty-five miles, where it tailed into a series of swamps, which lay in the natural drainage line of the country. From this point it was simply a chain connecting a series of lakes, either natural or artificial. Each village usually has a lake, which is made by the excavation of mud for the construction of the houses in the village, and this during the rainy season fills up with water, and is in some cases sufficient for all purposes for a year. This was frequently not the case, hence each village agreed to dig the canal through its land, into the lake at one side and out at the other, along the lowest ground, when the next village took it up as far as its boundary; by this means a low level canal was constructed of varying width and capacity, along the natural drainage line of the country. Wherever a river or channel was met with in its course, these were pressed into the service of the canal. Native

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cities sprung up on the banks of the canal with temples, bathing ghats, mosques, and such like. One branch was carried through the main street of the city of Delhi, in a covered channel with frequent manholes for the purpose of drawing water, for drinking, watering trees, flushing the streets, and daily ablutions of the people. The Persian word for climate is ab-o-hawa, *i.e.*, water and air, hence the Oriental rulers always did their best to supply water of some kind or other to their subjects. Up till the last few years this branch of the canal was the only supply of water to the city of Delhi, and as it is the centre of all the trade of Northern India, the importance of keeping the canal intact could not be overrated. The country has only recently become ripe for the introduction of waterworks, and these are now being designed for all large towns. From these channels as constructed, and from the lakes called locally Jhils, irrigation was practised. The embankments, considering that the canal ran down the lowest point of the valley, blocked every outlet for the natural drainage surface of the country through which it passed, the level of the subsoil water was raised, and malarial fever made its appearance in bad form. Still the cry of the cultivator was for more water, for during the regime of native rulers he had never enjoyed to the full extent the fruits of his labour, it was answered by the canal being improved, the banks being raised, and by other methods likely to increase the supply, and its duration. Annually something was done; however in 1848 the cantonment of Karnal, then a frontier station, through which the canal flowed, had to be broken up, as the troops were decimated by malarial fever. In 1857 came the troublous times of the mutiny, and all public works had to be stopped, it was not until 1864, or thereabouts, that the question of remodelling the canal was taken up, and then it was done in earnest. It was then that it was realised that the cause of the outbreak of sickness in the cantonment was the raising of the subsoil water, and the pestilential exhalations from the swamps, the latter being kept full of water by percolation from the canal.

A medical examination of the villages along the banks was made, and it was found that nearly 75 per cent. were suffering from enlarged spleen due to repeated attacks of this malarial fever. The cultivator, in his anxiety to make money, had neglected his health by pouring water on to his land, without providing any outlet for the removal of it when it had done its work.

If this was not rectified, it was plain that in course of time, a very short time, the canal population must come to an end.

A large comprehensive scheme of reform, in which the author was largely engaged, was then undertaken, and the outline was as follows: To abandon thirty-four miles of the canal, and to substitute an entirely new channel on the ridge of the country, to remodel the remaining portion of it, and to make drainage cuts to the River Jumna, using the abandoned channel as a collecting medium.

Then in the matter of irrigation, only twenty-five per cent. of the area commanded by the new channel was allowed to be watered, and that only if one crop was grown in the year. Rice cultivation was prohibited near towns and in villages where the subsoil water was proved to be high, as this crop requires four times the quantity of water necessary for the ripening of any other crop, and this must be drained off twice a week, and fresh water substituted. The construction of this old canal on native methods, showed clearly what must be avoided in the future; the third part of this Paper will show what has been done to make irrigation a source of profit, as well as a benefit, and how the health of the population has been improved in all tracts served by the new system of agricultural engineering.

It may be remarked that the mode by which the State reimburses itself for the supply of water, is by assessment on the land, and not by its sale by volume. The latter is theoretically the correct method, but its application has not yet been found practical in India. On a finished irrigation scheme, the greater portion of an Engineer's time is employed on the checking and distribution of the area irrigated. Hence he has always at his disposal the means for arresting any misuse of water. We now pass on to the third part of this Paper, but the author fears that this vast subject has only received scant treatment at his hands.

The term Irrigation as interpreted in India, has a very comprehensive meaning. Construction of canals is only one branch of it, famine duty is another, the control of water another, training rivers and making flood embankments another, planting trees in bare tracts, experimenting with new farm seeds, acclimatising trees such as the Persian and Arabian Date Palm and the salt bush, fodder crops such as the Reana Luxurians, all this comes into the day's work of the Irrigation Engineer. He must cultivate habits of observation, watchfulness, and activity, or go into another branch of the service. The word irrigation means agricultural engineering, pure and simple. All the Punjab rivers are working Westward; the author has seen the Indus come west, by eroding half a mile along its *western* bank, for a mile in length, in a day. The house in

which he lived for two years on its banks, was built originally ten miles from the main stream, and at the end of 25 years, the river was flowing through the drawing-room. The nearest village had been rebuilt three times in the same period. If these streams had not been kept under control by training works, embankments, and abstraction of water by canals, many villages now prosperous, would, ere this, have disappeared.

To resume the main subject of the third part of this paper, canals are beneficial to the health of the people, in that they supply water for drinking, domestic purposes, and agriculture, to many tracts where there was no water before. They increase the food supply, by rendering agriculture possible where it was before impossible, they increase the rainfall by moistening the soil and enabling trees to be grown, these latter again absorb the malaria rising, especially during the night in the hot season, from the saturated soil. Pure mountain water, carried down the canals into the plains, will, if admitted occasionally, make the water in a brackish well, sweet. In the latter case objection is sometimes raised by the agricultural classes, as they have a theory that canal water causes impotence; but of this there is no proof.

Irrigation is only an adjunct to the rainfall, canals cannot do their work single-handed, their capacity, therefore, will in some measure depend on the average rainfall. To develop irrigation scientifically, and this is a *sine quâ non* if health is not to suffer, the following procedure must be carefully observed in aligning a new canal. The general configuration and slope of the country having been ascertained, an approximate line for the main canal may be laid down, to be corrected afterwards as more detailed levels and surveys are received. On the main ridge the main canal is located, on the minor ridges the branches; no irrigation is permitted from the main canal direct, as this interferes with the regulation of the supply, and each branch has its area for irrigation marked off separately. It must be accepted as an axiom, to be observed in all irrigation projects, that the natural drainage must not only not be interfered with, but that provision must be made to carry off the additional water thrown on to the soil by artificial means. The importance of this will be manifest, when it is understood that the quantity of water required during an average season of rainfall to bring a crop to perfection, is about 5,000 cubic yards to the acre. Thus, a rainfall of thirty-six inches, only supplies half the quantity, and so irrigation doubles, as it were, the rainfall. If the above quantity could be secured by rain only, distributed evenly over the time during which the rice crop is in the ground, there would be scarcely any need for irrigation, or special provision

for drainage; but this rarely or never happens, as the rains fall capriciously, often in such heavy bursts, that the natural drainage lines are unable to carry off the extra volume of water, much less the additional quantity due to irrigation. Hence if drainage lines are crossed, ample provision must be made for carrying the volume of water due to a maximum rainfall.

Again, while the main lines of drainage are kept clear, the minor depressions which feed them should also be unobstructed, otherwise after a lapse of some years the ground will become waterlogged, the depressions fill up and disappear, and the surface water run off so slowly that a great deal will be absorbed. The end of this is that the subsoil water will rise, and the danger of this has already been illustrated. Now to take the first one of the heads enumerated at the beginning of the third part of this paper, *i.e.*, the supply of water for drinking, domestic purposes, and agriculture. There are many parts of Northern India, notably Bikaneer and the North West Frontier, where the water is 100 feet or more below the surface of the ground, and therefore the expense of making a well by the crude methods available in the desert is almost prohibitive. The water when reached has all to be lifted to the surface by men or women, or bullocks yoked to a rope which passes over a wooden wheel. The other end of this rope is attached to a leather bag or leather bucket. The labour is thus enormous, the quantity raised each time very small, in no case sufficient for agriculture and often barely sufficient for domestic purposes. In some cases the cattle go a three days' march for water, and then return to their village, they thus only get water every three days. In other cases the people go ten miles daily with donkeys and bring back sufficient water for the day's use for themselves. In others they go in the afternoon to the nearest quicksand, arriving at night, they then dig a well in the sand and wait there till morning for the water to rise in this well. In such places the land falls into disuse, the people, unless there is a copious rainfall, either die of starvation or disease prostrates them. These are the tracts selected for canals, and annually such progress is made, as to place beyond the chance of famine those with whom it was a frequent visitor, and to enable the people by increasing their wealth to buy more food, clothes, and ordinary medicines. Next in order comes the cultivation of trees and the increase of the rainfall thereby, as the former is usually a cause of the latter. For example, on the new Chenab Canal in the desert between the Chenab and the Ravi, the rainfall went up in five years from 16 inches to 22 inches, enabling lands too high to be irrigated by a canal to be cultivated for the first time for years. As a safeguard against

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malaria, trees are invaluable, for if planted along a piece of low lying swampy ground they absorb the exhalations from the soil; a canal engineer will usually fix the site of his abode near a belt of trees. These must not, however, be so dense as to stop the current of air circulating about the house.

It was stated in the second part of this paper that the cantonment of Karnal was broken up in 1848, owing to the ravages of malarial fever, due entirely to the vapours given off by the swamps formed round it, by the banks of the Western Jumna Canal having obstructed the natural drainage of the country. In 1887 during the author's residence in the civil station there, which latter was located close to the old cantonments, the health of the residents was excellent, and has continued to be so, with few exceptions. This improved condition was mainly brought about by the growth of a large belt of trees, principally the Babul, mostly self-sown along the edge of the swamps, which absorbed the exhalations and kept off malaria. On going to the other side of the trees, the smell was so overpowering, that the immediate result was vomiting. This the author personally tested. The best trees for the purpose are the Babul, the botanical name of which is Acacia, Arabica, and the Melia Azadisecta; the former is very easy to cultivate, the latter rather difficult.

Lastly comes the purification of a well containing brackish water, by the admission of canal water.

Brackish water has few ill effects on those who drink it regularly, but on those unaccustomed to the taste of it, it produces diarrhœa and sore throat, developing occasionally into enteric fever; by admitting the water of a canal containing pure mountain water, once or twice a month in the cold season, and covering up the well, the sweetening of the water is almost invariably the result; the author is not prepared to explain why; suffice it to say that such has been proved to be the case. This paper will now be closed with a few remarks on the location of the Punjab canals, the preliminary observations necessary for the projection of the same, the testing of the depth of the subsoil water, and their effects on the turbulent and lawless classes.

The Punjab has five main rivers from which it takes its name, Panch Ab, these run from north to south, and finally joining at Mithunkote, pass on together in one stream called the Indus, into the Indian Ocean at Kurrachee. Between any pair of these rivers, canals are located, the head generally being in the mountains where there is a regular supply of water, the banks are composed of rock, and the bed of boulders. This enables a weir to be constructed across the river with safety,

but the length is three-quarters of a mile to one mile and a quarter.

The volume of flow is observed most carefully for years previously by independent observers, both in flood time and also at the period of low supply, these results are tabulated, and the necessary deductions made. It may be asked why the volume of flow of a river is not measured by the amount of the rainfall on its catchment area, the reply to this is, that the sources of the rivers being in the mountains, in many cases unexplored, and their heights being covered with perpetual snow, any calculation of this kind would be misleading, and as the flow observations have been reduced to almost absolute accuracy, this method of guaging is always now employed. It is continued from month to month, even after the canal has been made; the records, therefore, are as perfect as it is possible for them to be. It is useless to take discharge observations occasionally, as no conclusions can be drawn from them, but a regular systematic series of them have everything in their favour, and especially when freely criticised as they are in India, and that by men who have spent almost a lifetime on canal work.

All Hindus take a daily bath in the waters of the rivers or of the canals, and if this ablution is not performed daily, their religious monitors call them to account. If these channels are not available for the purpose, they go and draw water from the well, and standing on the rim of the well the water is poured over the body, and finally passes back again into the source from whence it came.

Here is a very fruitful source of disease, and hence village ponds and lakes are filled from the canal free of charge, if the water is used only for domestic purposes and watering of cattle. If for irrigation, a charge is made just as if it were taken direct from the canal. The wisdom of this course cannot be overestimated; a village pond is truly insanitary, all the villagers perform their ablutions in it, and cattle entering to drink, leave in solution their droppings, and the water is frequently drunk by the people. Such a source of water supply cannot be too often purified by the admission of pure mountain water.

Each irrigator before he receives water, has to level his land so that all of it receives the same amount of liquid, and he has also to mark it off by small ridges of one foot in height, which enclose compartments of 36 feet square. By this means the ground cannot be irrigated to excess, besides there is great economy in the amount of water used. The rise of the subsoil water is tested every six months as follows: Before the admission of water into the canal, wells are selected five miles apart on each bank, and at a distance of one mile from it. A

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bench mark is fixed on each of these, and from this, as a datum, the depth of water from the ground surface is measured. Any regular substantial rise is at once followed by the restriction of irrigation in that block, this is the only possible alternative, as there is no subsoil drainage. A difficult question to answer is as to what must be the depth of the subsoil water, so as not to be prejudicial to health. The author has found that in the dry lands of the Punjab, about 30 feet from the surface is not attended with any bad effects, but again in some cases a depth of 15 feet has not been found to do any harm. This matter is still under consideration in India, and it is at present impossible to lay down any hard and fast rule until the results of the well measurements, which have now been taken for twenty years, have been tabulated, and each tract made the subject of enquiry. Between each pair of rivers there are different conditions and different classes of people using different methods of agriculture, hence different conclusions will in all probability be drawn from these measurements.

The amount of water required for each crop has been reduced to almost mathematical accuracy by taking flow observations, and by measuring the crops twice a year for revenue purposes. Any village showing signs of deterioration in health or in productiveness of the land, is at once made the subject of enquiry. Women do not suffer apparently to the same extent as men from the evil effects of excessive irrigation; the author can recall a very bad case which came under his notice of a village in which there were reported to be 7 men and 300 women, and in which only one male child was born in three years. This village was notoriously over-irrigated. A native of a canal district will disregard his health if he can only get plenty of water and good crops, hence Government interference is necessary if the agricultural class, which is the mainstay of India, is to be preserved.

It was this class which, during the trying times of the mutiny of Delhi in 1857, was industriously ploughing outside the walls of the city, while the British and native troops were bombarding it, and it was due to the loyalty of this class also that no canal engineer lost his life during the same period. There are few localities where artificial irrigation is not indispensable at some period of the cultivating season, yet the volume of water required to mature various crops, in their respective seasons differs greatly. Malaria generally follows the excessive cultivation of rice or indigo, as these two crops require a very large amount of water. Irrigation has converted turbulent and discontented races into peaceful and healthy agriculturists, by given them water to cultivate land which before brought forth

nothing, and the author has on the very confines of British territory, fertilised fields cultivated by men who by tradition were for ages freebooters and robbers, while on the opposite bank of the river lies a trackless waste the resort of the lawless and discontented, and the scene of many a murderous raid. The Hebrew maiden of old, after asking her husband to beg of her father a gift of land, added on her own account "give me a blessing; thou hast given me South land, give me also springs of water."

NOTES ON LEGISLATION AND LAW CASES.

Prepared by Prof. A. Wynter Blyth.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

COURT FOR CONSIDERATION OF CROWN CASES RESERVED.

Before Mr. Justice Hawkins, Mr. Justice Mathew, Mr. Justice Cave, Mr. Justice Grantham, Mr. Justice Charles, Mr. Justice Vaughan Williams, Mr. Justice Lawrence, Mr. Justice Wright, Mr. Justice Collins, Mr. Justice Bruce, and Mr. Justice Kennedy.

(*Times*, May 29th, 1894.)

THE QUEEN *v.* DENNIS.

Case exemplifying the law, P. H. Lond., 1891, *sect.* 47, *where bad and good fruit are mixed together, and sold wholesale by brokers with the tacit or expressed undertaking that the good is to be separated from the bad.*

Judgment was delivered in this case (argued last sittings), which raised an important question as to the liability of wholesale dealers or brokers under the enactment in the Public Health Act (London), 1891 (54 & 55 Vict., c. 76, section 47, subsection 3), for having for the purpose of sale as human food articles of food unsound and unfit for the food of man. The defendant, a wholesale fruit broker of Covent Garden, had been tried and convicted before Mr. Warry at the Sessions; but a case was stated on which the question was argued. The Court had taken time to consider their judgment, which now, it will be seen, was, with one dissentient, delivered in his favour, the conviction being set aside. The case was thus stated by Mr. Justice Hawkins in his judgment:—The defendant being an English and foreign fruit and potato broker, carrying on his business in Covent Garden, on the 11th of October, 1893, received into his warehouse a consignment of eighty-three bags of Grenoble walnuts for sale on behalf of a foreign owner. One bag was taken from the bulk as a sample, and there is no suggestion that it was unfairly taken. The walnuts in that bag were good, and when the bulk was received by the defendant there was nothing in the external appearance of any of the packages of which it was composed or in their weight or smell to indicate that

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they were not equal to the sample. It was admitted, however, by the defendant that the walnuts were of a cheap quality, and that the husks having been removed by chemicals, they were liable to go bad quickly, and that when he sold the bags hereafter mentioned he knew that most of the bags would in all probability contain a greater or less number of walnuts which were bad and unfit for the food of man. On Saturday, October 21st, ten bags were sold to a customer, who, later on in the same day, returned eight of them as bad—that is, as containing so many bad nuts that it was not worth the trouble and expense of separating them from the good. Knowledge of this return, however, did not reach the defendant until Monday, the 23rd—this was the first intimation the defendant had of the actual condition of the walnuts. Upon receiving this intimation the defendant caused the whole of the bulk then in his possession to be examined, and such of the bags, twenty-three in number, as were found to be worthless were destroyed. In the meantime, on the same day the ten bags were sold, but before the return of the eight bags, Charles Lyon, a wholesale and retail fruiterer, after examining the sample, bought and paid for twenty other of the bags. Such purchase and payment was made at the pigeon hole of the pay-desk in the defendant's shop, over which was exhibited a large printed notice in big type as follows:—"Special notice to buyers. Original packages of either fruit or vegetables, the contents of which may partly prove unsound, either from delay in transit or any other cause, are sold on the express condition that the buyers sort the contents and destroy the unsound portion before being offered to the public.—W. Dennis." As to which see "Symonds *v.* Payne" (30 *L. J.*, Ex., 256); "Sandys *v.* Small" (3 Q.B.D., 449). In addition to this notice it was proved that it was the practice of fruit brokers in Covent Garden to sell foreign fruit in the packages in which it comes from abroad, without examination of the contents, except by opening one or more samples according to the size of the consignment, and by seeing whether the outsides of the packages showed any signs of damage, and by testing the weight and smell; that packages were frequently sold, although the brokers knew, or had reason to believe, some part of the contents were bad and unfit for human food, but that as between the brokers and the buyers it was the buyer's duty to see that the bad fruit was separated from the good and destroyed, and that none of it was offered to the public. It was moreover stated by the witnesses that there was neither time, nor room, nor skilled labour enough obtainable at Covent Garden to enable the brokers to sort the good fruit from the bad before it was sold by them. None of the walnuts sold to Lyons were ever offered by him for sale, for when, on the evening of the day on which he had purchased, he emptied the contents of the bags on to his barrow he discovered that the greater number of them were bad. He thereupon determined to return them to the defendant, and at once endeavoured to do so but was unable, it being Saturday evening, and after business hours, the defendant's shop was closed for the day. He kept the walnuts, therefore, until the following Monday, October

23rd, when he handed them (at the Vestry Hall, as stated in the indictment) to the Sanitary Inspector for the Vestry of Bermondsey, by whom, on the same day, they were taken to a police magistrate, inspected and condemned by him as unfit for the food of man, and destroyed. On these facts the counsel for the defendant contended, first, that no offence under subsection 3 of section 47 had been shown, because that subsection only applied where the person in whose possession the articles in question were found had himself committed an offence under subsection 2; secondly, that if the defendant had contracted with Lyons, that Lyons should, in accordance with the notice, sort out and destroy the unsound fruit from the walnuts sold to him, the defendant would not be guilty of the offence charged, and that the notice was evidence of such a contract; thirdly, that the jury should be asked whether the defendant, when he sold the packages, knowing there were some bad ones among them, intended the bad or only the good ones for the food of man. The chairman overruled the first and second contentions and declined to leave the question (3) to the jury, and he directed the jury to find the defendant guilty if they found that he sold the walnuts to Lyons, and that the walnuts were at the time of sale unfit for the use of man; unless he proved that at the time he sold them he did not know, and had no reason to believe, they were unfit for the food of man. And he further told the jury that the defendant could not contract himself out of the liability to a penalty under the Act by agreeing with Lyons to sort out and destroy the bad nuts, and they must altogether disregard the notice. The question has now been argued whether on this direction the conviction could be supported, and the judgment was now delivered that it could not.

Mr. Justice Kennedy, as the junior Judge, now delivered his judgment first, which was in writing, and to the effect that the conviction could not be supported. It was necessary, he said, to prove that the article found in the possession of the purchaser was liable to be seized under the first part of the section, and it could only be so if intended for the food of man and sold or kept for the purpose of sale as food of man, and the facts showed that this was not so. There was evidence that Lyons did not purchase the bad walnuts as the food of man, and that could only be found as a fact by the jury when left to them; but the learned Judge had limited them to the question whether there was a sale by the defendant of nuts unfit for the food of man and his knowledge of the condition of some of them, and, indeed, he directed them to disregard the notice. There was, therefore, no finding by the jury of a fact material to a conviction, and the conviction, therefore, must be set aside.

Justices Bruce, Lawrence, Charles, Cave, all concurred.

Mr. Justice Mathew dissented.

Mr. Justice Hawkins, however, proceeded to read a written judgment, in which all the Judges concurred except Mr. Justice Mathew, to the effect that the conviction could not be supported, the true question having never been left to the jury. It *may be conceded* that walnuts are articles of food liable to seizure

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by a Sanitary Inspector under such circumstances, but under such circumstances only, as are specified in subsection 1. That is to say, if, being intended for the food of man, they are found by such inspector on any premises, sold, or exposed for sale, or deposited in any place for the purpose of sale, or of preparation for sale, and if on inspection and examination they appear to such inspector to be unfit for the food of man. The mere possession of an article of food ordinarily used as human food which is in an unwholesome condition is not unlawful; nor is the sale of it for any other purpose than for human food. It may be lawfully dealt with and sold for manure, or for a variety of other purposes not necessary to enumerate. It is the sale or exposure of it with the intention that it shall be used for human food which is an essential element to the rendering the possession of it illegal; and it is immaterial whether the sale be with the intention that the purchaser is himself to be the consumer or whether it is sold with a view to its resale for human food by the purchaser. The burden of proof that such intention did not exist is, by section 47, cast upon the person charged with an offence, and in the absence of such proof the intention to sell for the food of man will be assumed if an article ordinarily so used be found exposed for sale or sold, &c. The non-existence of such a criminal intention is a fact to be established by evidence, and may be proved in a variety of ways; among others, for instance, a *bonâ fide* contract with the purchaser subject to a condition that an article unfit for human food should not be so used, or disposed of to be so used by others, would be evidence to negative such intention. I say a *bonâ fide* contract because a mere illusory formal contract to that effect, coupled with an underlying intention that the restrictive stipulation need not be observed, would be worthless as a protection to the accused; but the evidence of the contract, together with the question of *bonâ fides*, ought to be considered by the justices if they have to determine the case, or submitted to the jury, if the defendant elects to be tried by jury, for their consideration; and such jury ought to be asked whether they find the criminal intent negatived by the evidence. In this case, I think, having regard to the practice of the trade as mentioned in par. 9 of the case and the notice, there was evidence for the jury to consider. (See "Symonds *v.* Payne," 30 *L. J.*, Ex. 256; "Sandys *v.* Small," 3 Q. B. D., 449.) And if they upon such evidence had come to the conclusion that the defendant *bonâ fide* did not intend the articles to be, and that he sold upon an express condition that they should not be used for the food of man, until the bad walnuts had been separated from the good ones and destroyed, the defendant would have been entitled to an acquittal. Of course, I do not mean to say that the mere fact that the contract of sale was in accordance with notice would of itself be conclusive as a defence; for the issue before the jury upon the point now under discussion would be, not whether such a contract was in fact made, but whether the alleged criminal intent had been disproved by it with the other evidence, if any. I only say that the contract was evidence material to the issue, and, in my opinion, the Chairman was wrong

in refusing to leave the question I have suggested, and which was in substance that which the learned counsel desired should be left to the jury. I have personally entertained a doubt during the consideration of this case, when articles of food of the same character—*e.g.*, oranges—some portions of which are good and some bad are mixed together, but the bad are severable from the good, and are not in such proportion to the good as to make the whole unfit for human food, how the Sanitary Inspector and the justices ought to deal with them. It is not necessary, however, to settle that point to day. I turn my attention now to the offence created by subsection 3. To constitute such an offence it must be shown—first, that articles liable to seizure were found in the possession of a person who has purchased of the person accused, for the food of man; secondly, that when so purchased the articles were in such a condition as to be liable to be seized and condemned. Put shortly and in order of time, it amounts to this—that the articles must have been liable to seizure when sold by the accused to his purchaser; that they were bought by such purchaser for the food of man; that they were found in such purchaser's possession; and, when so found, were liable to seizure. Upon the facts stated in the case I fail to see any evidence of these requirements to justify the conviction. 1. I think it cannot be truly said that the walnuts were, even according to the ordinary meaning of the term, "found" in the possession of Lyons at all. 2. They were voluntarily taken by Lyons to the Sanitary Inspector at the Vestry Hall; the inspector simply took them into his possession at Lyons' request. They were not, therefore, in any sense of that word, "seized" by the inspector. 3. They were not when handed by Lyons to the inspector (even if that could be called a finding and seizure) liable to be seized under subsection 1. They were certainly not then intended for the food of man, for they were handed to the inspector with a view simply to their destruction as unfit for food. They were never, whilst in Lyons' possession either sold or exposed for sale, or deposited in any place for the purpose of sale, or of preparation for sale; and if upon the facts disclosed in the case Lyons had been charged before the magistrate he could not have been lawfully convicted under subsection 2. That the walnuts were purchased by Lyons with a view to the ultimate sale of such as were good could not be denied, but his intention to sell for human food the bad with the good is inconsistent with his conduct in not offering any for sale, but voluntarily handing them all over for destruction, as though they were trade refuse (see subsection 8 of section 47 and section 33 of the same Act). The absence of all proof that the walnuts were found or were liable to seizure whilst in Lyons possession would alone be fatal to the conviction; but even in the defendant's possession, bad as they for the most part were, they were not seizable for condemnation, even in his warehouse or in his shop, nor could he have been convicted, if he could prove that the nuts in their unwholesome condition were not sold or offered for sale, nor intended for the food of man. Proof of the absence of such intention the defendant was undoubtedly entitled to offer to the jury. His

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counsel endeavoured to do so. The evidence so offered was, in my opinion, very material to that issue, and I think the Chairman wrongly rejected it. I am also of opinion that the direction of the Chairman to the jury was erroneous. He seems to have forgotten that to satisfy the requirements of the third subsection, essential to a conviction, the jury ought to have been asked to find upon the facts necessary to establish not merely the sale by the defendant to Lyons, and that the nuts were then unfit for human food, but that they were liable to seizure under subsection 1, both in the hands of the defendant and of Lyons—that liability involving those most important questions of the intention of the defendant and the object or purpose for which the nuts were sold by the defendant to and purchased by Lyons. I do not agree altogether in the first contention of the defendant's counsel—viz., that the defendant could not be convicted under subsection 3 unless Lyons could be convicted of an offence under subsection 2; but I do agree that Lyons must have been placed in circumstances which would render him liable to a conviction, unless he could establish that the walnuts, had they been seizable when in his possession, were not purchased or intended by him for the food of man. The circumstances as against each must be such as to constitute a *primâ facie* case against each, but the guilt of each must depend upon whether the criminal intention existed—*i.e.*, to sell for human food. One might be able to disprove the existence of such intention, the other might not. In such an event one would be guilty, the other would not. So that the innocence of the purchaser because he disproved by evidence the criminal intention would not protect the vendor, who might not be able to offer such evidence. It is not, however, worth while to further notice the point raised, because no *primâ facie* evidence of any offence by Lyons was offered; and the defendant is entitled to an acquittal on other grounds. I think the conviction ought to be quashed, because, on the admitted facts, no offence under subsection 3 could be established, and because, even assuming a *primâ facie* case the Chairman refused to put before the jury evidence tendered material for the defence, and misdirected the jury in telling them what would constitute guilt. The conviction must be quashed.

GENERAL NOTES.

The following questions have been raised by Correspondents:—

Query. In a provincial town of a population of 7000 there is a Cottage Hospital containing nine beds. All the important surgical operations of the town are performed in this hospital. In the operating room is a sink, the contents of which are conveyed by nine feet of 1½ inch lead pipe, to discharge over a cemented channel leading to a gulley trap; the lead pipe is not trapped, the sink is not plugged. The refuse from an operation is thrown down this sink, and the enquirer thinks that the pipe must be coated with filth and act as an air inlet, and thus be a source of danger. G. K.

Answer. There can be little doubt that it is unwise to adopt the method of drainage described ; it would be preferable to have an open channel conveyed a little distance from the walls before entering a covered drain, so that every particle of blood or other *débris* after each operation could be washed away with water, and then afterwards the open channel disinfected. At the same time it is also perfectly clear that if the $1\frac{1}{2}$ inch pipe was systematically disinfected with strong disinfectant, there would be little if any danger. The amount of air coming through such a pipe, provided the operating room is otherwise well ventilated, must in most states of the atmosphere be small. A. W. B.

Query. A tenant has an agreement under seal for four years for certain premises, and there is a covenant that he will pay "all rates, taxes, assessments, repairs, and outgoings, whether chargeable to the landlord or the tenant," and a notice has been served by the Sanitary Authorities to reconstruct the drains. Is the tenant liable under his agreement. P. W. T.

Answer. Under the common law the tenant is *primâ facie* liable for the repair of drains and sanitary appliances. But under the Sanitary Acts there are special powers, and the "*owner*," that is, the person who receives the rack rent is liable to be called upon by a local authority to do any work of a structural character to abate nuisance. The writer does not state whether the house in question is within the Metropolitan area or not. This, however, makes but little difference, and it is my opinion on the facts stated that the tenant holding such an agreement is not liable to reconstruct the drains. If indeed he were so, it would be unjust, as compelling a person who has a transitory interest to do something amounting to a permanent improvement. A. W. B.

FROZEN FOOD.—A sum of £30,000 was recently expended in rendering the steamships of the Canadian-Australian line (established in 1893) suitable for the conveyance of produce in a frozen or chilled condition, and this fact is giving substantial stimulus to commercial enterprise in various directions. One syndicate has already constructed cold storage at Victoria, British Columbia, and another has erected cold storage at New Westminster, B. C., and is about to erect similar premises at Vancouver, so that Canada will thus speedily have abundant provision for dealing with frozen meat from Australia. A third syndicate, formed in London, proposes to supply both Australasian and British markets with frozen Canadian salmon, as distinguished from the familiar tinned variety. The fish would be sent to Sydney from British Columbia in the insulated holds of the Canadian-Australian steamers, and that intended for Great Britain would be transhipped at Sydney to the P. and O. or Orient liners, and thence sent direct to London, thus travelling a total distance of about 18,000 miles. Trial shipments of about ten tons each of frozen salmon have been forwarded to Sydney and to London. Should it be found that the flavour is uninjured by the freezing process an important trade will, it is expected, be opened up. Cold storage has also been provided at Fiji, which will shortly be receiving regular supplies of frozen mutton from Australia in exchange for her

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supplies of sugar, copra, and pines and other fruits. Fiji now finds herself, in fact, on the highway of the world's traffic, and so important are the commercial developments being brought about there that Sir John Thurston, the Governor of Fiji and High Commissioner and Consul-General for the Western Pacific, will shortly visit London for the purpose, among other things, of advancing them still further. It is also proposed to erect cold storage at Honolulu, where, already, owing to the new line of steamships, an important trade has been opened up in bread stuffs, and manufactured goods sent through British Columbia from Pacific coast points to the Hawaiian group.

QUARANTINE STATIONS.—The Brazilian Minister for Foreign Affairs has informed Her Majesty's Chargé d'Affaires at Rio de Janeiro that Tamandaré has been definitely chosen for the site of the new quarantine station, and that, in the opinion of the head of the commission charged with the works, they will be concluded in three years. Her Majesty's Chargé d'Affaires is pressing on the Brazilian Government the necessity of adopting suitable provisional measures pending the completion of the new station.

SWEATING IRONWORK IN SHIPS' FORECASTLES.—For some years my attention has been drawn to a great nuisance which is often found existing in the forecastles and other berths on board iron steamships; it is one of which little notice seems to be taken, for during the construction of a vessel it could easily be remedied, and at a small cost. There appears to be more interest taken in the construction of the hull, and matters that concern the safety of the ship, than in the comfort of those who have to exist in the small space allotted to seamen. In doing so their comfort is neglected and unfortunately the owners do not always learn the cause of the complaints or of the ill-health of the men in their employment. Sometimes the masters are afraid to report to their owners defects that may have been brought to their notice by the crew. The "*Nuisance*" to which I desire to draw especial attention is caused in many instances by moisture dripping from the overhead ironwork on to the crews berths, and by the near situation of the berth to the vessels sides, there being no protection from the moisture. The result of the condensation is that the berths are wet and unfit to be occupied, and the seamen are deprived of sufficient rest, and frequently contract colds and chest affections. I have had forecastles that were damp and dirty placed in a habitable condition without having to serve the usual Statutory Notice, for should any master fail to comply with our requirements upon the certificate of the Port Medical Officers of Health, an order would be obtained as in the case of a damp house, so that the berths could not be occupied until they had been declared fit for habitation by the Port Medical Officer of Health. There are various methods in which the crews of vessels can be protected from exposure to damp ironwork, viz:—

1. By sheathing the inside ironwork with wood.
2. By painting and covering the iron with fine cork dust whilst the paint is wet; this should be covered with a solution of limewash and glue-size mixed.
3. By laying a planked deck on top of the iron deck, and providing efficient through ventilation.

By these means many of the forecastles now in use could be made healthier at a small cost, and would rid our seamen of the nuisance caused by the condensation upon ironwork in their berths. W. H. C.

We have received from Dr. L. Palazzo an account of a meteorological station recently attached to the laboratories of the Public Health Department

in Rome. The authorities, recognising the important connection between various diseases and atmospheric conditions, have provided the station with a full set of instruments, and intend to instruct students belonging to the school annexed to the laboratories in their use, and to include, among other studies, a short course of meteorology as applied to hygiene. The results of the observations will be regularly published in a special bulletin, with a view to determining more particularly the medico-climatology of that city.— ***Nature*, June 20th, 1895.**

MEETINGS HELD APRIL TO JUNE, 1895.

SESSIONAL MEETINGS.

A meeting was held on April 3rd, at 8 p.m., when a discussion was opened by John F. J. Sykes, D.Sc., M.D., and W. Nisbet Blair, Assoc.M.Inst.C.E., on "Combined Drainage from the point of view of Health, Construction, Administration, and Law;" Professor A. Wynter Blyth in the Chair. About 200 Members, Associates, and Visitors attended. (See page 274.)

LECTURES AND DEMONSTRATIONS TO SANITARY OFFICERS.

A course of 12 Lectures was given at the Technical Schools, Norwich, in conjunction with the Norfolk County Council, and the Technical Educational Committee, Norwich, commencing March 30th and ending June 29th. 30 Students entered their names for this course.

EXAMINATIONS.

Examinations for Inspectors of Nuisances.—These were held in the following towns:

Southampton, April 5th and 6th. 10 candidates presented themselves, and 9 were certified to be competent as regards their sanitary knowledge to discharge the duties of Inspectors of Nuisances. Dr. A. W. Harris, the Medical Officer of Health, attended as a visitor.

London, May 3rd and 4th. 161 candidates presented themselves, and 93 were certified to be competent as regards their sanitary knowledge to discharge the duties of Inspectors of Nuisances.

Leicester, June 14th and 15th. 20 candidates presented themselves, and 12 were certified to be competent as regards their sanitary knowledge to discharge the duties of Inspectors of Nuisances. Dr. J. Priestley, the Medical Officer of Health, attended as a Visitor.

Examinations in Practical Sanitary Science.—London, May 3rd and 4th. At the first examination 18 candidates presented themselves, and 9 candidates were granted certificates in practical sanitary science. A second Examination has been arranged in December (particulars of this Examination are given in the advertisements).

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FORTHCOMING MEETINGS.

Calendar, June to October, 1895.

Council Meetings are held Monthly on the Second Wednesday in each Month, except August and September.

Finance Committee	Second Wednesday.
Exhibition Committee	First Tuesday.
Congress and Editing Committee . . .	Second Monday.
Education Committee	Third Monday.
Museum and Library Committee . . .	Fourth Monday.

JULY.

12 F. } 13 S. } Examination for Sanitary Inspectors, Huddersfield.

19 F. } 20 S. } Examinations for Sanitary Inspectors, Norwich.

30 T. Reception at the Parkes Museum during the meeting of the British Medical Association. Tea, 4.30 p.m.; followed by discussion on Public Health.

31 W. Ditto.

AUGUST.

1 Th. Reception at the Parkes Museum during the meeting of the British Medical Association. Tea, 4.30. p.m.; followed by discussion on Pollution of Streams.

2 F. Ditto, discussion on the Bacterial Purification of Water.

SEPTEMBER.

3 T. Lecture to Sanitary Officers, London, 8 p.m. Elementary Bacteriology, by R. J. Hewlett, M.D., M.R.C.S.

6 F. Lecture to Sanitary Officers, London, 8 p.m. Elementary Physics and Chemistry. I. (Mechanical Physics), by J. Castell-Evans, F.I.C.

10 T. Ditto. II. (Natural Forces), by J. Castell-Evans, F.I.C.

13 F. Ditto. III. (The Atmosphere, its Physical Properties), by J. Castell-Evans, F.I.C.

17 T. Lecture to Sanitary Officers, London, 8 p.m. IV. (Water), by J. Castell-Evans, F.I.C.

20 F. Ditto. V. (The Chemistry of Fuel and Combustion), by J. Castell-Evans, F.I.C.

24 T. Ditto. VI. (Sanitary Chemistry), by J. Castell-Evans, F.I.C.

25 W. Inspection and Demonstration in the Parish of St. George's, Hanover Square.

26 Th. Lecture to Sanitary Officers, London, 8 p.m. Ventilation, Warming and Lighting, by Louis Parkes, M.D., D.P.H.

OCTOBER.

1 T. Lecture to Sanitary Officers, London, 8 p.m. Sanitary Law: English, Scotch and Irish; General Enactments Public Health Act, 1875, Model By-Laws, &c., by Her. Manley, M.A., M.B., D.P.H.

2 W. Inspection and Demonstration at Stoneyard and Disinfecting Station, Marylebone, 3 p.m.

4 F. Lecture to Sanitary Officers, London, 8 p.m. The Law relating to the Supervision of Food Supply, by A. Wynter Blyth, M.R.C.S.

5 S. Inspection and Demonstration at

8 T. Lecture to Sanitary Officers, London, 8 p.m. Sanitary Laws and Regulations governing the Metropolis, by A. Wynter Blyth, M.R.C.S.

9 W. Inspection and Demonstration of Casual Wards and Disinfecting Station, Chelsea.

11 F. Lecture to Sanitary Officers, London, 8 p.m. Objects & Methods of Inspection, by J. F. J. Sykes, D.SC., M.D.

12 S. Inspection and Demonstration at Southwark and Vauxhall Waterworks, Hampton, 3 p.m.

15 T. Lecture to Sanitary Officers, London, 8 p.m. Nature of Nuisances, including Nuisances the abatement of which is difficult, by Arthur Newsholme, M.D., D.P.H.

16 W. Inspection and Demonstration at the Disinfection Station, &c., at St. Pancras, at 3 p.m.

18 F. Lecture to Sanitary Officers, London, 8 p.m. Trade Nuisances, by Prof. A Bostock Hill, M.D., D.P.H., F.I.C.

19 S. Inspection and Demonstration at Knacker's Yard, Whitechapel.

22 T. Lecture to Sanitary Officers, London, Water Supply, Drinking Water, Pollution of Water, by Prof. W. H. Corfield, M.A., M.D.

23 W. Inspection and Demonstration at the East London Soap Works, at 3 p.m.

25 F. Lecture to Sanitary Officers, London, 8 p.m. Diseases of Animals in relation to Meat Supply; Characteristics of Vegetables, Fish, &c., unfit for food, by Alfred Hill, M.D., F.R.S.E.

26 S. Inspection and Demonstration at Richmond Main Sewerage Works, Mortlake, 3 p.m.

29 T. Lecture to Sanitary Officers, London, 8 p.m. Infectious Diseases and Methods of Disinfection, by Edward C. Seaton, M.D., F.R.C.P.

Receptions during the Meeting of The British Medical Association in London.

The Council of the Institute have arranged to receive at the Parkes Museum those members of the British Medical Association and International Geographical Congress who are interested in the Public Health.

Receptions will be held each afternoon during the meeting. Tea at 4.30 p.m., followed by discussions.

The Subjects proposed are :—

July 30. The Health of London.

„ 31. Geographical Distribution of Disease.

Aug. 1. Pollution of Streams.

Introduced by George Reid, M.D., D.P.H., M.O.H. Staffordshire County Council.

„ 2. The Bacterial Purification of Water.

Introduced by Prof. Percy Frankland, F.R.S.

These Receptions will be open to Members and Associates of The Sanitary Institute.

Further particulars can be obtained at the Office of the Institute.

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HON. FELLOWS, FELLOWS, MEMBERS, AND ASSOCIATES ELECTED.

From April to June, 1895, inclusive.

HONORARY FELLOWS.

1895. May. Cerezo, Dr. Angel de Larra y, *Costanilla de los Angeles* 8, *Madrid.*

1895. May. Pacheco, Dr. Modesto Martinez y Gutherez, *President, Spanish Society of Hygiene, Madrid.*

1895. May. Faria, Don Pedro Garcia, *Ingeniero Jefe, Obras Publicas Municipales, Barcelona.*

1895. May. Kitasato, Dr. Med, *Tokio, Japan.*

FELLOW (Fellow San. Inst.)

1895. May. Barwise, Sidney, M.D. D.P.H. *Cantab.*, 40, *St. Mary's Gate, Derby.*

MEMBERS (Mem. San. Inst.)

* Passed Examination in Practical Sanitary Science.

‡ Passed Examination as Inspector of Nuisances.

† Passed Examination as Local Surveyor.

1895. Apr. †Blake, Henry Kynaston, *Engineers' Office, Guildhall, E.C.*

1895. June. ‡Brown, Reginald, *Public Buildings (District Council Offices), Ealing, W.*

1895. Apr. Cooper, Dossabhoy Nowrojee, D.P.H. 45, *Ampthill Square, N.W.*

1895. June.*‡Davies, Thomas, 79, *Walthall Street, Crewe.*

1895. Apr. Dhurandhar, Krishnarno Vishwanath, *Medical Officer and Sanitary Commissioner, Baroda, Bombay Presidency, India.*

1895. June.*‡Evans, Ernest Arthur, 13, *Jeffreys Road, Clapham.*

1895. June. *Fearon, Thomas Laurence, 27, *Guildhall Street, Folkestone.*

1895. June. *Gruggen, Reginald M., A.R.I.B.A., 37, *Spring Gardens, S.W.*

1895. June. McGee, John Henry, M.B., B.CH., D.P.H. (*Cora Linn, Brighton, Victoria, Australia*), 4, *Caroline Street, Bedford Square, W.C.*

1895. June. *McKillop, John, 96, *Haldon Rd., Wandsworth, S.W.*

1895. June. *Miller, George, 93, *Gloucester Road, South Kensington, S.W.*

1895. Apr. Morton, Edward Handfield, F.C.S., *Compayne Mansions, South Hampstead, N.W.*

1895. June. *Puttenham, Henry, 15, *Burton Road, Brondesbury.*

1895. Apr. Shackleton, Charles William, *Engineer and Surveyor, Coseley District Council, Bilston.*

1895. Apr. †Waldram, Robert Edward, 6, *Manor Road, Leyton, Essex.*
1895. June. *Weeks, George, Junr., *High Street, Bromley, Kent.*
1895. June. Winter, Wallis John, *Surveyor (Rural District Council, Bromley), Sidcup, Kent.*

ASSOCIATES (Assoc. San. Inst.)

‡ Passed Examination as Inspector of Nuisances.

1895. June. ‡Bacon, Charles Thomas, 7, *Charteris Road, Kilburn, N.W.*
1895. May. ‡Barrett, Fred, *Farnhill, Kildwick, Keighley.*
1895. May. ‡Berry, Robert, 27, *Above Bar, Southampton.*
1895. June. ‡Brown, Robert Edward, 5, *Chenies Place, Pancras Road, N.W.*
1895. June. ‡Butcher, Frederick Edward, 7, *Rutland Terrace, Schuckburgh Road, Catford, S.E.*
1895. June. ‡Campion, Thomas Benjamin, 41, *Caird Street, Queen's Park Estate, W.*
1895. June. ‡Carter, George Henry, 65, *Torriano Avenue, N.W.*
1895. May. ‡Chowins, William Henry, *Cooper Street, Bideford, Devon.*
1895. Apr. ‡Cobham, George William, F.S.I., 1 *&* 3 *Edwin St., Gravesend, Kent.*
1895. May. Davidson, Thomas, *Urban District Council, Willington Quay, Northumberland.*
1895. May. ‡Douglas, William, *Glanton R.S.O., Northumberland.*
1895. June. ‡Evans, Miss Edith Mary, *South Road, The Park, Nottingham.*
1895. Apr. ‡Evans, Henry, 88, *Plassey Street, Penarth, Cardiff.*
1895. June. ‡Flowerdew, William, 30, *Ashbrook Road, Upper Holloway, N.*
1895. May. ‡Foxcroft, Thomas Armitstead, *Rock House, Settle, Yorkshire.*
1895. June. ‡Green, George, 1, *Grafton Road, East Acton, W.*
1895. Apr. ‡Hill, William Krebs, 17, *Aigburth Road, Grassendale, Liverpool.*
1895. June. ‡Hutchings, Albert, 36, *Barnwell Road, Water Lane, Brixton.*
1895. June. ‡Keasley, James, 25, *Glovers Road, Reigate.*
1895. June. ‡Keogh, Miss Nellie M., 36, *Esmonde Road, Chiswick, W.*
1895. Apr. ‡Lowe, Miss Eugenie Albanus, *Mildmay, Blackburne Place, Liverpool.*
1895. June. ‡Lucas, Arthur, 158, *High Road, Streatham, S.W.*
1895. May. ‡MacMillen, John Robert, *The Cottage, Earsdon, Northumberland.*
1895. June. ‡Martin, Harry, 21, *Francis Road, Acocks Green, Birmingham.*

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1895. June. ‡Mathews, Charles Collard, 10, *Werrington Street, Oakley Square, N.W.*
1895. June. ‡Norton, Thomas Henry, 48, *Elizabeth Road, Upton Park, Essex.*
1895. May. ‡Pile, Joseph Thomas, 28, *Hillfield Road, West Hampstead.*
1895. June. ‡Pope, Arthur J., *Glenroy, Selsdon Road, West Norwood.*
1895. May. ‡Porter, John, 68, *High Street, Perth.*
1895. June. ‡Rayner, Frederick John, 60, *Manor Park Road, Manor Park, Essex.*
1895. June. ‡Redston, Frank, *Landseer House, Woodlands Park Road, West Green, Tottenham.*
1895. June. ‡Redston, Walter, *Landseer House, Woodlands Park Road, West Green, Tottenham.*
1895. June. ‡Ricardo, Miss Ellen Gertrude, 25, *Cleveland Square, Hyde Park, W.*
1895. Apr. Rowland, Thomas, *Borough Surveyor, Stratford-on-Avon.*
1895. May. ‡Scott, James William, 23, *Jane Street, Workington, Cumberland.*
1895. June. ‡Sykes, Joseph Robson, 66, *Gilmour Street, Thornaby-on-Tees.*
1895. June. ‡Thompson, James G., 77, *Clemence Street, Limehouse, E.*
1895. June. ‡Toogood, William Thomas, 21, *Vicarage Road, Croydon.*
1895. May. ‡Tribe, F. C., *Borough Offices, Tun's Gate, Guildford.*
1895. May. ‡Whitaker, Walter H., *Y. M. C. A., Bath.*
1895. June. ‡White, George, 389, *Harrow Road, Paddington, W.*
1895. Apr. ‡Wood, Harry, 7, *Station Road, Walthamstow, Essex.*
1895. May. ‡Wormald, John, *Riding Head, Luddenden, viâ Manchester.*
1895. Apr. Young, Arthur, c/o *Messrs. Jennings, Palace Wharf, Lambeth, S.E.*

OBITUARY.

SIR GEORGE BUCHANAN.

Sir George Buchanan was born in Myddleton Square in 1831; he was educated at University College, London. His career as a student was most distinguished, and he received numerous scholarships and prizes. He took his degree as M.D. (Lond.) in 1856, and appears to have been immediately appointed Medical Officer of Health for St. Giles',

in which district he did notable work, and utilised as much as possible the then somewhat scanty powers possessed by sanitary officers. He also obtained the appointment of Physician to the London Fever Hospital, and made several excellent investigations of various forms of fever. In 1861 his services were utilised by the Privy Council in an enquiry into the working of the Vaccination Acts, and subsequently in 1865 as to the prevalence of typhus in the North during the cotton famine; he undertook the important enquiry as to how far good drainage and water supply had improved health, and for this purpose collected facts by personal enquiry from twenty-five towns. He proved so conclusively that the application of sanitary principles on a large scale to Urban populations resulted in a decrease in disease generally and an improvement in the public health, that to his report on this subject may be traced the impetus given to sanitary legislation. He also showed for the first time that dampness of habitation had some intimate connection with the local incidence of tubercular disease, a fact accentuated by the subsequent observations of other observers. In 1869 Dr. Buchanan was appointed a permanent Inspector under the Privy Council; in 1871 he was transferred to the Local Government Board as Assistant Medical Officer; and in 1879 he was appointed Chief Officer.

Dr. Buchanan was knighted on his retirement in 1892; he retired because he was suffering from ill-health, and required rest from official duties. At this period, however, Lord Basing died, and Sir George Buchanan was pressed to take the Chairmanship of the Royal Commission on Tuberculosis, the report of which has been recently published. It was probably unwise at so critical a period to have undergone the fatigue and responsibility that such an office necessarily entailed. Directly the labours of the Commission were brought to a close, he submitted to an operation which had been for some time necessary, and although the operation appeared at first successful, Sir George was seized with a sudden faintness on May 5th and suddenly died.

Few in the Public Health Service have had so long and so honourable a career. His death is a distinct loss to the Nation.

In the Parkes Museum he took much interest, and was a Vice-President up to the time of its amalgamation with The Sanitary Institute.

He will be remembered by all Medical Officers of Health who came into contact with him as a most courteous friend and colleague, ever ready to assist with sympathy or

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active help in any difficulty. He was a clear and even brilliant writer, and his facts were always reliable. It is much to be regretted that such long services were so scantily rewarded; a knighthood and a scanty pension was all that the Government had to offer. The high price paid for mere political services, and the indifference with which the most splendid achievements of the pioneers in the cause of Preventive Medicine are regarded, is a subject that calls for animadversion.

A. WYNTER BLYTH.

CHARLES HENRY PARKES.

CHARLES HENRY PARKES was born in the year 1816. He was educated at Christ's Hospital, with his brother the late Dr. Edmund Parkes, F.R.S., Professor of Military Hygiene at the Army Medical School, Netley. In the year 1830 he entered the Election Office in the House of Commons, and when in 1834 the Houses of Parliament were destroyed by fire he joined the firm of Dyson & Co., Parliamentary Agents. Shortly afterwards he became a partner in the firm, and took an active part in preparing and bringing before Parliament many of the various schemes which now form part of the existing railway system of the country. He retired from business in the year 1868 owing to indifferent health, but shortly afterwards joined the Board of the Great Eastern Railway Company. After serving for one year as Deputy Chairman, he became Chairman of the Company in 1874, an office which he continued to hold until the year 1893, when owing to advancing years he retired. Mr. Parkes died on May the 9th, having survived his wife three years. He leaves five sons and two daughters, Dr. Louis Parkes, Medical Officer of Health for Chelsea, being the third surviving son. The funeral took place at Weybridge Cemetery on May the 14th, Mr. Parkes having been a resident at Weybridge during the past 26 years.

Mr. Parkes was a Vice-President of the Parkes Museum (which was established as a memorial of his brother), and after its incorporation with The Sanitary Institute of Great Britain, became a Fellow of the new body, The Sanitary Institute, and during his lifetime contributed largely to both bodies.

G. J. SYMONS.

EXHIBITS ADDED TO THE MUSEUM.

JANUARY—JUNE, 1895.

DIVISION A.

Science in Relation to Hygiene.

Glass Model for demonstrating the air permeability of Soil. *Purchased.*

Apparatus for demonstrating the quantity of water absorbed by bricks or other building materials. *Purchased.*

Calculator. "The Gem." *Purchased.*

Calculating Slide Rule, Fuller's Patent, for the use of Architects and Actuaries. *A. Newsholme, M.D.*

DIVISION B.

Hygiene of Special Classes, Trades, and Professions.

India Rubber Pad for Carriage Steps.
Presented by the Birmingham India Rubber Co., Manufacturers.

DIVISION C.

Construction and Sanitary Apparatus.

Wire Wove Semi-Transparent Roofing Materials.
The Wire Wove Roofing Company, Manufacturers.

Folding Partition (Working Model) for dividing Schools, Public Buildings, &c. *Presented by Peace & Norquoy, Manufacturers.*

Bib Valve (Section), with arrangement for Stopping Water Supply when under repair. *Presented by J. Stone & Son, Manufacturers.*

Filter (Full scale Model in Section).
Presented by the Grand Junction Water Works Company.

Lavatory, "Modern," with accessible overflow.
Presented by Shanks & Co., Manufacturers.

Lavatory, "Instanter," for use in Schools.
Presented by Shanks & Co., Manufacturers.

Portable Turkish and Shower Bath.
Presented by Rev. W. S. Walford, Inventor.

Pneumatic Regulator for after flush of Valve Closet (Working Model). *Presented by J. Tylor & Sons, Manufacturers.*

Column Closet, lipped as Urinal.
Presented by J. Tylor & Sons, Manufacturers.

Earth Closet (Model). *Presented by G. V. Poore, M.D.*

Fungus. Specimen taken from a 9 in. drain.
Presented by J. E. Rugg.

Electric Apparatus, including Radiator, Hot Plate, and other Domestic Appliances. *Crompton & Co., Manufacturers.*

"Enable" Joint for joining Lead to Earthenware, fixed to a P Trap.
Presented by Thos. Robinson, Inventor.

Air Valve (Drawing of Section). Bateman & Moore's Patent for Automatically relieving the pressure of Air in Water Mains.
Presented by Guest & Chrimes, Manufactnrers.

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Pressure Reducing Valve (Sectional Drawing) for Water Mains.
Presented by Guest & Chrimes, Manufacturers.

Gas Governor (Sectional Drawing) for Gas Mains.
Presented by Guest & Chrimes, Manufacturers.

DIVISION D.

Personal and Domestic Hygiene.

Pasteur Germ Filter (Model), with Glass Cylinder fitted for pressure with one Candle or Bougie.
Presented by J. Defries & Sons, Manufacturers.

Lantern Slides. A collection of 250 slides, illustrating Bacteriology, Physics, Meteorology, Physiology, Drainage and Sanitary Appliances, Parasites. These slides can be borrowed by Members and Associates of the Institute for lecture purposes. *Purchased.*

Museum Cases. Appliances and various exhibits.
Presented by the Executors of the late T. Twining, of Twickenham.

CONTRIBUTIONS AND ADDITIONS TO LIBRARY

from April to June, 1895.

*** *For publications of Societies and Institutions, &c., see under "Academies."*

ACADEMIES (American).

Philadelphia. *College of Physicians.* Transactions, Third Series Vol. XVI. 287 pp., 8vo. Philadelphia, 1894. *The College.*

ACADEMIES (British).

London. *The Institution of Civil Engineers.* Speeches at the Annual Dinner, March 27th, 1895. 27 pp., 8vo. London, 1895.

——— *The Institution of Civil Engineers.* Minutes of Proceedings, Vol. CXX., 1894-95, Part II. 498 pp., 8vo. London, 1895.
The Institution.

——— *Royal Institution of Great Britain.* Proceedings, Vol. XIV., Part II., No. 88. 235 pp., 8vo. London, 1895. *The Institution.*

——— *Society of Chemical Industry.* Journal, Vol. XIII., for the year 1894. *The Society.*

——— *Society of Engineers.* Transactions for 1894 and General Index, 1857 to 1894. 289 pp., 8vo. London, 1895.
The Society.

——— *The Sanitary Inspectors' Association.* Report of the Extraordinary General Meeting and the Ordinary Monthly Meeting, April 6th, 1895, together with a paper on "Some reasons why Sanitary Inspectors do not occupy their statutory position," by W. H. Grigg. 136 pp., 8vo. London, 1895. *The Association.*

London. *The Sanitary Inspectors' Association.* Report of the Proceedings and Speeches at the Twelfth Annual Dinner, February 2nd, 1895. 34 pp., 8vo. London, 1895. *The Association.*

——— *The Sanitary Inspectors' Association.* The Position of a Sanitary Inspector, by W. Wilkinson, and Report of the Ordinary Monthly Meeting, March 2nd, 1895. 28 pp., 8vo. London, 1895. *The Association.*

Liverpool. *Sanitary Inspectors' Association, North Western District.* Eighth Annual Report, 1894. 19 pp., 8vo. Liverpool, 1895. *The Association.*

ACADEMIES (CONTINENTAL).

Roma. *R. Universita di.* Annalli dell' Istituto d'Igiene sperimentale della. Vol. IV. (Nuova Series), Fasc. II., 116 pp., 8vo., Ditto, Fasc. III., 118 pp., 8vo. Roma, 1894. *The Institute.*

Albrecht, *Dr. H.* Handbuch der Praktischen Gewerbehygiene. 560 pp., 8vo. Berlin, 1894. *Purchased.*

Alexander, *Frederick William.* Report to the Sanitary Committee (Board of Works, Poplar District) on the cause of Diphtheria, its suggested relation to the Main Drainage of London. 21 pp., 8vo. London, 1894. *The Author.*

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JOURNAL OF THE SANITARY INSTITUTE.

THE POSITION OF MEDICAL OFFICERS OF HEALTH IN REGARD TO THE ADMINISTRATION AND WORKING OF THE INFECTIOUS DISEASES NOTIFICATION ACT.

By Sir Thomas Crawford, K.C.B., LL.D., Q.H.S., M.D.

Read at the Reception of Members of the British Medical Association by the Institute on July 30th, 1895.

Sir Thomas Crawford said that the object of the Institute in offering a reception in their Museum and Library to the members of the British Medical Association, and particularly to the country members now in London, was simply to give them an opportunity of seeing what the Institute was doing. The hour had been arranged in order not to interfere with the ordinary meetings of the British Medical Association. They did not propose to have any very protracted discussions at the meeting, but it had been thought well to choose subjects on which they could have a friendly talk which might prove useful to those who knew less about their proceedings than members of the Institute. The meetings would be held each afternoon and the subjects to be offered for consideration were duly set forth on the card. Any Medical Officers of Health or other gentlemen who could give information upon points to which attention might be called, would have an opportunity of doing so, and would be gladly heard.

He proposed to call attention to a subject of considerable importance, namely, the relationship of Medical Officers of Health, first to their qualified brethren, the general practitioners in the neighbourhood, and secondly to the inhabitants of the district.

With regard to Medical Officers of Health, it was generally admitted that the position of those who were also general practitioners was not quite satisfactory. They had not an independent position which would enable them to treat discreetly and skilfully the matters that must come before them. Some had experienced considerable difficulty in administering the law, not only because many of the conditions were optional, but also because in administering them the Medical Officer of Health was in the unenviable position of being supposed to interfere with his neighbours, the ordinary practitioners. He thought that for this and other reasons it was undesirable that Medical Officers of Health should be in practice. Moreover, their whole time and attention ought to be given to the discharge of their duties, which could not be the case if they were in practice. The observance of this rule would at once remove all difficulty when it became necessary to take legal action in respect of cases of infectious disease. If Medical Officers of Health were of that opinion, and if the fact were brought formally before the Government, he thought it might be found practicable to liberate them from these impediments. As far as he was concerned he was neither a Medical Officer of Health nor a medical practitioner. He spoke simply as the head of a family, but at the same time being a medical man, he was more or less interested in the subject from a professional point of view. As the head of a family he had had some very telling experiences. During the last six years his house had been in quarantine on three occasions for months at a time owing to the fact that having a large family of boys they not unfrequently brought home visitors which would have been gladly dispensed with. During the attacks of scarlet fever, measles, &c., the neighbours would hardly look at them.

The prevalence of these infectious diseases and their spread was the principal reason why the Government had given them these sanitary laws, and sanctioned the appointment of experienced medical men to assist in their administration. There was one other point in connection with this duty which had not perhaps received the attention it deserved from the Government when framing these laws, viz., the great danger of turning the people against them. The English people were not afraid of risking either their lives or their health in the interests of those whom they loved, and they were consequently not easily persuaded to part with any member of their family simply because he or she happened to be suffering from an infectious disease. It was very important to make it clear that it was not only for the general good, but for the particular and *immediate* good of the family, that measures should be taken to

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stamp out these diseases, and therefore to try and induce them to submit voluntarily to any necessary isolation. Any attempt to remove a member of a family contrary to the wishes of the family was sure to excite hostility and ill-feeling, even although they might not be well prepared to isolate the case in their own homes to the entire satisfaction of the sanitary authority. An injudicious medical officer by attempting to adopt coercive measures might do more harm in his district in a few hours than the best efforts of sanitary associations would be able to remedy in years. He had before him an extract from the *British Medical Journal* of July 13th dealing with a case in which the "Medical Officer of Health of the district stated that he had observed an ambulance in the parish, and, not having been notified of any case of infectious disease, he kept the vehicle under observation, and ascertained that a child suffering from scarlet fever was removed in it." It appeared that a medical man in the district had sent for this ambulance, having diagnosed a case of scarlet fever which he proposed to remove to the hospital. But the medical man had not immediately sent in his notification to the Medical Officer of Health, and the result was that he was prosecuted and fined. Now a case of that kind was, he thought, evidence of a want of judgment on the part of a Medical Officer of Health. His duty would have been equally well done if he had contented himself with taking the necessary steps to see that the law was complied with. When, however, a Medical Officer of Health resorted to the employment of detectives, then he thought he was doing an unwise thing. With regard to the public at large it was, of course, a matter of vital importance that the laws regulating the removal of cases of infectious disease should be thoroughly well understood, and that effect should be given to them with the consent and concurrence of the people. Therefore all institutions, which had for their object the cultivation of sanitary science and the education of the people in these subjects, ought to impress upon everyone connected with the administration of sanitary acts the importance, nay, the necessity, for carrying the people with them. Coercion in such matters was a fatal blunder. With regard to the diseases at present required to be notified under these Acts, he suggested that when an opportunity occurred the propriety of revising the list might well be considered. The term "infectious diseases" under the Diseases Notification Act includes the following:—Small-pox, cholera, diphtheria, membranous croup, erysipelas, scarlet fever, typhus, typhoid, enteric, relapsing, continued, or puerperal, and includes, as respects any particular district, any infectious disease to which this Act has been

applied by the Local Authority of the district in manner provided by this Act.

He had already mentioned that he was not a general practitioner, and he certainly had never had the privilege of exercising the functions of a Medical Officer of Health. He had had, nevertheless, a great experience of such cases, and he would not hesitate to say that a large proportion of them could be thoroughly dealt with in any well-regulated house, with careful nursing, attention to cleanliness, isolation, &c., without any need of removal to a hospital. Therefore, instead of extending this list of diseases, as was contemplated, it might be found in practice to admit of a reduction. While, however, a locality had the power of grouping any form of fever amongst these diseases, it devolved upon the Medical Officer of Health to be exceedingly judicious and careful with regard to any action he might take. The Medical Officer of Health might consider it necessary, and where doubt existed it might be his duty, to visit a patient for the purpose of confirming the diagnosis of any particular disease, and it was said that unless he had the opportunity of doing so, he could not possibly be held responsible for any action he might take in a matter of that sort. But the responsibility of action in such a matter would not rest with him if he did not take that step. On the whole he thought it should not be a matter of discretion; if it were necessary, the law should lay it down that it was his duty so to do. But going into a house for such a purpose, unless by invitation of the medical attendant, was more likely to create obstacles than to facilitate the administration of the Act. He apologised for having offered these crude and desultory remarks by way of opening the discussion. He hoped that the gentlemen whom he saw there, many of whom were better qualified than himself to speak on the subject, would take the opportunity, and he would gladly leave it in their hands, premising that as the time at their disposal was not very long, they should not waste any of it.

Dr. Alfred Hill (Birmingham) concurred in the general tenour of the remarks which their Chairman had made with regard to the duties of the Medical Officer of Health. He agreed that the absence of friction in the working of the Notification Act could only be obtained by providing that the Medical Officer of Health should not be a private practitioner. It unquestionably did rile a practitioner

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that his next-door neighbour, who, though a practitioner himself, happened to be a Medical Officer of Health, should come in and diagnose against him, possibly spitefully. Even the non-practising Medical Officer of Health might get into trouble unless he displayed great caution in interfering with the diagnoses of the general practitioner. Moreover, he did not think the law required him to do anything of the kind. He himself was Medical Officer of Health for a large town with nearly half a million inhabitants, and he had carefully avoided interfering unnecessarily with the diagnoses of practitioners. The law placed the onus of the diagnosis and of certifying thereto on the general practitioner. The practitioner was presumably a competent man, he had received a professional education, and he was placed in the position of an expert. He himself held, therefore, that it would be presumption and impertinence on his part to set his own experience against the practitioner's. Moreover, it was unprofessional. The Medical Officer of Health might ask the practitioner to visit a case in conference with him, but most medical men would object even to that, if the object of the Medical Officer of Health were to point out their mistakes. With regard to the difficulty of getting patients to go to hospital, that in his experience was merely a matter of habit and education. The first year of the existence of the Birmingham hospital they had only about twenty people removed to hospital, but when the children got home again and told their parents what a clean and pleasant place it was, how kind the nurses were, what constant attention they received, how pleasant the grounds, &c., were, the hospital began to get popular, and now, if anything, it was rather too popular, for when one child of a family was going to the hospital, others who had been there before, were apt to cry because they were not going too. Sir Thomas had said something about the Medical Officer of Health interfering with patients to constrain them to go to the hospital. This going into hospital was, he pointed out, a purely voluntary act: one could propose removal and set forth the advantages which the hospital offered, but there is no power to compel removal unless the people are improperly lodged, as for instance, when two or three families lived in the same room. It was only under these circumstances that removal might become compulsory, and there was no power to interfere with a householder. He had understood Sir Thomas to say that medical men neglecting to notify, ought not to be pressed hardly upon, but as that duty is really made compulsory, he did not see what other course was open, if the efficiency of the Act is to be maintained.

Sir Thomas Crawford explained that he was referring to the case of a detective being employed to ascertain whether a particular medical man had done his duty.

Dr. Hill, continuing, agreed that such means were objectionable, and would not be employed by any right-minded man. In Birmingham they found the practitioner acted as his own detective, because

if he sent a case of scarlet fever to the hospital which he had not properly notified it necessarily came to their knowledge through the Medical Superintendent. The duty which was incumbent upon the householder ought also to be, and is by law, incumbent upon the medical practitioner. The duties of the Medical Officer of Health were unquestionably disagreeable to some extent, and they should be performed in as agreeable a manner as possible. On the whole he thought they could as a body congratulate themselves on the fact that they discharged their duties in a fairly proper way. With regard to confirming the diagnosis as said to be suggested by Dr. Louis Parkes, he thought it would be a source of great trouble and heart-burning. He thought the Medical Officer of Health would be thus tolerated only if the law were altered so as to compel him to verify the diagnosis. He agreed in respect to the diseases notifiable by Act of Parliament that only a few of them required to be treated in hospital. Diphtheria, for instance, was a disease so little communicable, resembling typhoid in this respect, that it was really hardly necessary to compel these people to go into hospital if they could be isolated and properly attended to at home. If they were to attempt to send to hospital all infectious diseases, including measles, whooping cough and the like, they would require hospitals as large as towns. Measles was not generally required to be notified, but some towns had undertaken the duty, but they had found it very expensive, and, moreover, it had not been found successful in reducing the incidence of measles. In consequence of this result, in some cases where the disease had been added to the list, it had been subsequently struck off. Any attempt to increase the list in this direction would be resisted. At present there were certain diseases which might with advantage be removed from the list, among them erysipelas. Every trifling scratch, every little blush of erythema was put down as erysipelas and notified without any apparent practical utility.

Sir Douglas Galton (London) said he was not a medical practitioner so would speak from another point of view. He had, however, had a good deal of experience in his own County of Worcestershire in respect of Medical Officer of Health. He said it was quite certain that one could not have an efficient Medical Officer of Health unless they paid him well, and unless he were debarred from private practice. There would be many Sanitary Authorities in a County, Rural Authorities, who could not afford to pay a Medical Officer of Health well; therefore, if the Medical Officer of Health were to be well paid they must unite a number of districts under one Medical Officer. He had no doubt that this might be easily managed in rural districts, because where the Sanitary Inspectors were efficient they were the Medical Officer of Health's right hand. These officers would keep him informed of what was going on and so the work could be efficiently done. In his own County they had a County Medical Officer who had been appointed with the distinct understanding that he should undertake no private practice, but should give his whole time to the County, assisting to the best of his

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power any district Medical Officer who might apply to him. This system had worked very well, and the County Medical Officer was on good terms with all the district officers. They had adopted the notification of infectious disease in every district except one or two, which formed joint districts with neighbouring counties. In Warwickshire the County Medical Officer was in practice, and did not give his whole time to this work, and he did not think their administration was as perfect as in Worcestershire. In Worcestershire they had done an enormous deal of late years in stopping the pollution of rivers, and in removing a large number of unsanitary conditions. Their County Officer was very well paid, but the district officers were very badly paid. The appointment of district officer was made only for a limited period of years, and at the end of that time a great many of the Sanitary Authorities in the district took the opportunity of having a sort of Dutch auction with the endeavour to get the services of some medical man at a lower rate than those of the then Medical Officer of Health of the district. He knew of one case in which the Officer had to accept a much lower sum than he had been receiving in order to ensure his re-appointment. That was a great disgrace. The Local Government Board had complained of this action, but the District Authority had adhered to its opinion. Unless they could get the tenure of office of the Medical Officer of Health placed on a more permanent footing so as to make them irremovable, unless with the sanction of the Local Government Board, and unless they could get greater powers in some way for amalgamating districts, he doubted whether they would ever be able to get a really good service in the rural districts. As regards the treatment of infectious diseases in hospital, speaking as a member of the Metropolitan Asylums Board, he said they certainly found that year by year the number of patients who desired to go into their hospitals increased so largely that they were perpetually obliged to be constructing fresh hospitals. They had built three and were now thinking about building a fourth. In a short time they would be able to dispose of at least 6,000 beds for scarlet fever and diphtheria. The year before last they had had between 4,000 and 5,000 patients, and if those diseases happened to become epidemic those numbers would probably be greatly exceeded during the present year.

Dr. A. T. Brett (Watford) said he felt some diffidence in speaking after the Medical Officer of Health for Birmingham. He himself was a general practitioner of forty-five years standing. Since the establishment of a local board he had for twenty years been Medical Officer of Health, so he could speak from another point of view. The question he wished to raise was whether it was necessary to have a large district and to do away with people like himself. He did not wish to say anything in praise of himself, but during the twenty-two years he had held office he had never had any disagreement with his fellow practitioners. He never saw a patient unless he was asked, though he willingly gave his opinion in consultation. There were only 20,000 people in his district, but he thought it was a great

thing for Medical Officers to know their people. He got the work done somehow, and he did not think it would be a good thing for his district to do away with a man who was on the spot. If they had one large district stretching nearly all over the county he did not think the work would be as well done. He referred to a case that occurred the previous week; a notification had been received from London of a case of scarlet fever sent from his district, the patient went to the hospital where it was diagnosed, and had then come back in a third-class carriage to his district. He went to the house and found there were twelve children, four of whom had since contracted the disease. He thought that was a condition of things that ought not to have existed.

Dr. J. F. J. Sykes (London) observed that their Chairman had stated that he was not a general practitioner nor a Medical Officer of Health, but his natural modesty had precluded him from saying that he had been at the head of the Army Medical Department and had consequently had a large experience of infectious diseases. The question of removal to hospital in private practice was an interesting one. In his experience objection was very rarely made. Even if the suggestion of the Sanitary Inspector was badly received, when the Medical Officer of Health appeared on the scene he rarely if ever met with a refusal. The difficulty in London was not to get the people to go to the hospital, but to stop inappropriate cases going there: in fact, the expenditure of the Metropolitan Asylums Board was getting quite alarming, and if not checked would soon become a grievance to London ratepayers. Since the hospitals were full his instructions for some weeks past had been not to remove a case to hospital, unless the case was one of special urgency. The experience of London, at any rate, was not favourable to removal in the manner that Sir Thomas Crawford suggested was sometimes attempted in the country. In respect to the employment of detectives in such a matter, he thought Tallyrand's maxim would apply "Surtout point de zele." An excess of zeal in this direction was likely to lead to trouble. Ever since the commencement of the Act he had made a practice of writing to the medical man, telling him he was aware of the non-notification and asking for an explanation, and he had never failed to receive a reasonable explanation of the occurrence. Of course, if it came before a magistrate, that official was bound to act in accordance with the statute law, and must fine the defaulter. An ordinary individual who did not act by the legal code, but by the moral code, would be more likely to treat the matter in a proper and more reasonable light. He held that it was not a proper thing to take a case into Court without having taken steps to know the reason why the notification had not been made. He protested against measles and whooping-cough being included in the schedule. For a long time he "sat on the hedge" and considered the matter, but for some years past his opinion had gradually been growing stronger that it would be inadvisable. Several authorities who had included these diseases *had since* rescinded their resolutions. Lastly, as to the question of

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the Medical Officer of Health visiting patients, the Local Government Board had laid it down time after time that it was no part of the duty of the Medical Officer of Health to visit patients for the purpose of diagnosing infectious disease in cases of doubt, and that he thought was a very proper attitude to take. Personally he declined, and for this reason: if Dr. A. came to him saying he had a case, as to which he was in doubt, and requesting his opinion, it might happen that Dr. A. having pronounced an opinion may have to cease attendance, and Dr. B. might be called in. Under these circumstances his own position would be an embarrassing one, for Dr. B. might differ in opinion from Dr. A. Each practitioner, in fact, must be his own judge. If he (the speaker) did go to see a case he went without consulting anybody, and in the interests of the public, but he never did so without having very good reasons. Dr. Seaton (Medical Officer of Health for Surrey) also took this attitude, and he has caused it to be known that when two medical men differ he will, with the consent of both parties, act as judge. He thought that was a wise attitude. The principal occasion when the Medical Officer of Health should appear on the scene was when there was an absolute refusal to allow an un-isolated patient to be removed to hospital. In the first place to judge whether the case was properly isolated or not, and secondly, whether there was any danger to the public, for that after all was his principal duty. He cannot go behind the certificate given him under statute unless he could prove *mala fides*. It is his duty to act upon that certificate, and if he wishes to remove the case to act for the protection of the public.

Sir Thomas Crawford (London) said, in reference to what had fallen from him as to the action of the Medical Officer of Health, he had turned up Dr. Parkes' book to see what he actually did say on the subject. At page 175 Dr. Parkes says:—"There is no obligation laid upon a Medical Officer of Health to examine a patient certified under the Act to be suffering from an infectious disease in order to verify the diagnosis." Then he goes on to say that when he thinks it necessary, it ought, of course, to be done with all due discretion. No objection could be raised to a Medical Officer of Health examining a case of small-pox or typhus, seeing that special measures were called for which the Medical Officer of Health could more conveniently recommend after being satisfied in his own mind as to the nature of the disease. He referred to a case in illustration in which a medical officer of a hospital had a case under treatment in the wards not for infectious disease. He diagnosed it as scarlet fever and sent it to the special hospital. Shortly afterwards it transpired on observation that it was not a case of scarlet fever. Now the girl happened to be the servant of a solicitor who immediately threatened proceedings against the practitioner who had caused the girl to be transferred, but on receiving a fuller explanation allowed the matter to drop. This was a contingency which might happen to anyone in the early stage of scarlet fever, and might not be so readily passed over.

THE TEACHING OF HYGIENE AS ILLUSTRATED BY THE PARKES MUSEUM.

By Prof. A. Wynter Blyth, Barrister-at-Law, M.R.C.S., F.I.C., F.C.S.,

Chairman of Council.

Read at the Reception of Members of the British Medical Association by the Institute on July 31st, 1895.

Prof. Wynter Blyth said that he had been commissioned to say a few words respecting the history and object of the building in which they were. The Parkes Museum was founded in 1876 in memory of Professor Alexander Parkes. At first a separate and distinct institution, it found a temporary home in University College. In 1882 it was removed to its present quarters, recently enlarged by the addition of another house. In 1888 it was incorporated with The Sanitary Institute. The Parkes Museum was a collection of object lessons, illustrating the subject of hygiene and recording the development of sanitary science. Not less than 20,000 people annually visited the collection, showing that at least that number took an interest in the subject. During the past nine years systematic instruction had been carried on within its walls. In addition to an elaborate course of lectures and demonstrations encouraged by the Institute, no less than forty-two different colleges, medical schools, or societies, had during the present year sent their students to study the exhibits. The number of students who had availed themselves of these facilities was not far short of a thousand, a fair proportion of whom were ladies. He mentioned that the catalogue of the Museum had been published, which afforded every facility for examining the different objects which the Museum contained. He observed that often the least conspicuous objects in the Museum possessed very considerable interest. He had not the slightest doubt that ninety-nine out of 100 persons would pass by certain pipes (to which the speaker called attention) without supposing them to possess any particular interest. If, however, one examined them carefully, they would see certain transverse markings which indicated that they had been attacked by rats. He pointed out that it did not require a sanitary Sherlock

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Holmes to elucidate the fact that the presence of rats in a house (at any rate in cities) constituted a fair presumption of something being wrong. That might not be the case in farm-houses, for one might have rats in country houses without the drains being wrong; but in cities the home of the rats was in sewers, and if they escaped from the sewers through the house drains into the house, that fact afforded very substantial evidence of there being a direct communication between the sewers and the house drain. Therefore these markings on the pipes would tend to render a Sanitary Inspector suspicious. The catalogue was divided into various divisions. There was a classification which had been rigidly adhered to. Possibly the most interesting section was that dealing with bacteriology, but the limits of the building would not allow of their having a room devoted entirely to bacteriological subjects. A lecture, however, was given in their course of lectures to students on this subject. Dr. Hewlett had presented the Museum with a few specimens of micro-organisms, as exemplified in the tubes before him. He pointed out, in speaking of bacilli, it must not be imagined that the particular growth they saw in these tubes represented a single bacillus, on the contrary, each tube contained a colony of bacilli. Some of these were innocent, and some were more or less of a malignant nature. They had also a few specimens illustrating pathology, especially the pathology of parasites, flukes, trichinæ, tuberculosis in the ox, &c. Then there was a meteorological section arranged by Mr. Symons, with a very fair set of meteorological instruments detailed in the catalogue. There were also a number of lantern slides for lecture purposes, and these were made considerable use of by their own lecturers, and also by lecturers who went about under the auspices of The Sanitary Institute delivering lectures in different parts of the country. In Section B, devoted to the hygiene of special classes, trades, and professions, considerable space in the catalogue was devoted to plans and drawings of schools and artisans' dwellings. He did not mean to say that these were all models of construction, indeed many of them were models of what they ought to avoid in the future. Some towns, when demolishing large areas, had sent deputations to the metropolis to ascertain what sort and kind of artisans' dwellings it would be desirable to construct. Such persons would find it useful to consult the plans in this Museum.

The chief section was, however, Division C, dealing with building construction and sanitary apparatus, which constituted the most interesting and the most comprehensive collection in the whole Museum. In connection with this they had at the present time drawings, plans, and sections of the sewers, and

of the apparatus by which the sewage of London was dealt with. He believed that these drawings could not at the present time be found anywhere except at this Museum. These might be of great use to sanitary engineers as samples of construction. He referred them to a model on his right of various forms of brick walls set in wet sand showing the efficacy and the result of a damp-proof course, and without it. If they would examine it closely after the lecture, they would see that where there was a proper damp-proof course the moisture did not extend beyond that course, but in the absence of such a course the damp rose more or less up the wall.

The next exhibit gave them a visual impression of the enormous quantity of water that an ordinary brick would take up. It consisted, as they could see, of two bricks originally of exactly the same weight, poised on a pair of scales, and the amount of water in the beaker placed upon the dry brick represented the amount of water taken up by the moist brick. They would understand with regard to a house that was damp what an enormous quantity of water the wall must contain.

The diagram above that specimen showed a house that had been built in a very happy and fortunate position so far as view was concerned, but they would see from the diagram that unless that house had been built on a concrete foundation it was certain to be damp, for it had been built on a pocket of gravel, beneath which was an impervious stratum of close clay in which the water accumulated and rose by capillary attraction through the walls of the house. Beneath their feet they would see several examples of flooring, the floor of the Museum being a sort of patchwork just to illustrate the various kinds of flooring that were available—Mosaic, Wood Block Flooring, Parquet Flooring, &c.

Then there were various kinds of water-closets, to two of which he wished to call attention. These were both very bad forms of closets, one a long hopper, and the other the old-fashioned pan closet, there being under the container a D trap which very often caused disease. The particular exhibit he was referring to was connected directly with the cistern which was presumably used for drinking purposes, and he pointed out that whenever the valve was pulled bubbles of air found their way from the pan up through the water. That met an argument which had often been raised, for people sometimes said it was an impossibility if a closet was connected with a cistern, for gas to get from the closet up into the cistern. The exhibit in question showed very clearly the contrary. Such people reasoned as if the pipe going from the cistern to the closet was *always* full of water, which was by no means the case. This

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pipe might get full of foul air, and directly they got a connection between the cistern and the closet, that foul air was expelled through the water and contaminated it. Moreover, there were plenty of analyses showing that water in a cistern so connected often contained a considerable quantity of ammonia and was extremely impure. So they had a simple fact proved by ocular demonstration and other means. Some of the most modern forms of closets would also be found in the Museum. There were the Syphonic closets, which presented several advantages, though, on the other hand, they presented the disadvantage of requiring a three-gallon flush. The Sanitary Institute had accepted the doctrine established by some very careful experiments made by a committee of the Institute, that a two-gallon flush is not sufficient to keep a W.C. and drain perfectly clear. Unfortunately in the metropolis the water companies had laid down two gallons as the maximum quantity, and this limit had been sanctioned by statute. There was consequently a difficulty at the present time, and the law required altering in order to make it agree with the dictates of sanitary science.

With regard to drainage they had some special exhibits. A very useful one which he supposed had taught hundreds of students what a drain ought to be, was the large model on his left, showing a soil pipe with all kinds of joints, showing how a lead soil pipe should be connected with the earthenware pipe of the drain, an inspection chamber and an air inlet. It also showed how the soil pipe should be ventilated by being carried up full bore to the roof, and also how the various closets are to be connected with the drain which was provided with its ventilating pipe to prevent what was known as anti-syphonage. He then referred them to a drawing immediately above the model, of a drain which presented nearly every possible defect. It ran up and down, its contents were escaping into the earth, the root of a tree had grown through at one of the joints, a common enough accident; in the Museum, indeed, was a large root which was found inside a drain. It also showed a right-angle junction instead of a smaller drain joining the drain in the direction of the flow. The next junction was not inserted in the proper way. A drain such as that must necessarily pollute the ground in which it was laid, and would be liable to get choked.

The next drawing represented the damming back of sewage in the drain from a defective syphon. The arm of the syphon which went towards the sewer was bent in a faulty manner, in that the outlet was at a higher level than the arm of the house part. The consequence was that the drain never emptied itself. Then, with regard to traps of drains, there were all

kinds of traps to be seen in the corridor—bell traps, dip traps, and other kinds of traps that human ingenuity had devised. What they found extremely useful in instructing students was a fairly complete collection of apparatus for the testing of drains. Modern drains were tested by what was called the water test, also by what was called the smoke test. The water test was applied by plugging one end of a drain at the lowest joint and simply pouring in water at a higher point, and noticing whether the water level sank or not; if not, then the drain might be presumed to be sound, while if it did, then it certainly leaked. Instead of stopping the end of the drain up with clay, there were several more or less ingenious appliances which had been devised for the purpose. He showed one such, which, if of the proper size, firmly plugged it on being screwed up. He also showed a bag which was used for the same purpose, which had the advantage over the screw plug that it could be applied more easily in certain cases. Then there were smoke rockets. These were filled with a composition which emitted an enormous volume of smoke, probably something like the volume of smoke in the "Arabian Nights" which the poor fisherman let out when he uncorked the bottle which contained the genii. This was inserted into the drain after being lighted, the ventilating shafts having been plugged and the smoke being under pressure would find its way through any imperfect joint. Sometimes the defect was not shown by one rocket, and several had to be employed to get the requisite pressure. He then showed another kind of smoke rocket, which he said was being very much used at the present time. It was a comparatively small rocket, but it would burn under water, that is to say, the fuse was not extinguished by water. That was an advantage, inasmuch as it enabled them to pass it round the bend of a trap through the water. The holder attached to the rocket was used for drawing back the case after the discharge. All these various appliances were made great use of in the lectures and in the demonstrations to students.

There were also in the corridor a number of exhibits showing the results of faulty sanitation, the effects of gases on pipes and so on. He especially called attention to a fine collection of corroded D traps and corroded old pan closets, and also to some extraordinary sanitary arrangements which have been taken out of some of the best houses in the West-End and had been presented to this Museum, showing what serious sanitary defects might exist in high-class dwellings.

There was an excellent exhibit bearing on water supply, including a filter of one of the London Water Companies, full size filled with fine sand, coarse sand and pipes underneath.

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They had also diagrams one-quarter scale of the filtering beds of other companies.

He directed their attention to a new exhibit which had recently been presented to the Museum by a Member of their Council, illustrating the effects of pumping at a well on the surrounding strata. They would see that a well in the centre of a porous sandy soil reduced the water level over a very wide area. The fall of level in the form of a curve being shown by glass tubes symmetrically arranged outside. The more they pumped the more marked was the curve. In other words, the more water that was pumped, the more polluted would it be likely to be, drawing as it did its water from a larger area of surrounding soil. The arrangement of the model was in a linear series, but of course if the soil were homogeneous, the well would act more or less in a circle.

In the same division there were various ventilating appliances, cowls, tubes, and flaps, which could be seen in the gallery. Tobin's tubes, perforated bricks, ventilating windows, in fact, a fair example of the appliances at present in use.

Further on there were various forms of cooking apparatus. He thought it would interest the ladies to see the little apparatus on the table which showed a kettle being heated by electricity, than which one could hardly imagine a cleaner method of boiling or cooking, but unfortunately at present an expensive luxury. He also showed a radiator for heating a room by means of electricity, which did not require any flue. This, too, was unfortunately at present only a scientific curiosity.

With regard to Division "D" he would not say much about the various foods, or hospital and sick room appliances, but he could not dispense with saying a few words about filters. According to a very elaborate investigation, the results of which had recently been published in the *British Medical Journal*, the only filters that could be relied upon to make an injurious and polluted water safe to drink, were those in which there was very close packing together of mineral particles, such as the Pasteur and Berkefeld filters. The one was a sort of porous porcelain, and the other was a siliceous earth closely packed together. In such a tube as the one he held in his hand the spaces between the material must be extremely fine, so fine indeed that they did not appear to allow bacteria to pass through, and since bacteria were of extreme minuteness that would give them some idea of the fineness of the pores. On the other hand a great many waters were only polluted with a little harmless vegetable matter, and such waters could be freed from that by sand or other filtering medium, many varieties of which

could be seen in the Museum, such as the silicated carbon, the magnetic iron, &c., but it must be borne in mind that these would not free water from bacteria.

He hoped that these remarks would give them some idea of the Museum as a teaching institution, but beyond mere students it afforded technical knowledge to those engaged in the building trades, engineers, architects and others. If a builder wanted to know the various patterns of ventilators, sinks or drain pipes, he would find it an advantage to come to the Museum, especially as from time to time they had Congresses with exhibitions of sanitary appliances, to the best of which medals and certificates were awarded after careful examination and trial. It was more or less a rule that these exhibits to which medals were awarded should be deposited in the Museum, and that rule would doubtless be more strictly adhered to in the future; therefore, anything new or special in sanitary appliances would be likely to be found in the Museum.

In concluding his remarks he hoped they would admit that The Sanitary Institute did useful work although they had no State aid. In the Museum they had brought together a number of objects, not perhaps of interest as a show place, but of high value to all who were engaged in teaching hygiene, and of special value to the advancement of sanitary science as applied to domestic and public life.

Mr. H. C. Soper (London) called attention to the ventilation of public sewers, the gratings for which were generally in the roadway. He maintained that such a practice was altogether objectionable; in fact, the Vestries did what they would not permit a private individual to do. He asked why it was not made a rule to carry the pipes up against the wall of a house, as indeed it was done in some districts. He thought the practice of ventilating into the roadway was the cause of much illness.

Mr. A. Wynter Blyth, in reply, said that presuming that the sewers were perfectly made, as sewers of the best form were, they could give rise to very little offence. He admitted that in the old sewers where there were "dead-ends" offensive accumulations might take place. He pointed out that there were difficulties in the way of carrying pipes up the houses, since that could not be done without the permission of the landlord, and experience showed that such permission was very reluctantly accorded.

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RIVER POLLUTION.

By G. Reid, M.D., D.P.H.

Read at the Reception of Members of the British Medical Association by the Institute on August 1st, 1895.

Those who had the selection of the subject for discussion to-day have, designedly I take it, left me a free hand as to which of its many phases I shall deal with, for the possible ground which may be covered is in no way limited by the title. A limit, however, has been placed upon the time at my disposal, and although I appreciate, as no doubt you do, the wisdom shown by the Committee in this respect, those of you who have had occasion to devote much time to the study of the question will understand the difficulty I have experienced in framing the skeleton of my paper, so that, without exceeding the time limit, the main points should as far as possible receive due notice, and opportunity thus be given for a pretty full discussion.

By the rapid growth of the population and its aggregation into centres, combined with improved water-supplies, the systematic sewering of towns, and the abolition of cesspools, sewage which previously dissipated itself in the soil surrounding our houses, or found its way by numerous small outlets into water-courses, is now collected and carried to centres whence, as a rule after very indifferent treatment, if any, it is discharged into streams or canals. Thus, although one great evil has undoubtedly been remedied, another has been aggravated, and sanitary authorities throughout the country have been brought face to face with a most difficult problem.

Until the Local Government Act of 1888 was passed, and County Councils, endowed with important responsibilities under the Rivers Pollution Prevention Act, were established, local authorities had little to contend with, as a consequence of the increasing pollution, beyond occasional actions for damages brought by riparian owners and others. Now, however, things have altered, and County Councils as controlling authorities are in many instances exercising their powers with the view of effecting a radical change in the present unsatisfactory condition of things.

The question is by no means a simple one, and the law, except in those counties where special powers have been

acquired, does not help to simplify it, although it is satisfactory to know there is a prospect of a more workable Rivers Pollution Prevention Act being passed in the near future.

In the discussion to-day some may wish to deal with the question as it affects the public health, while others may prefer to address their remarks to the remedy; I propose, therefore, to refer to both points in introducing the subject.

Although by the sewering of towns the public health has greatly benefited, this is attributable more especially to the consequent improvement in house and land drainage, and the advantages have not been attained without some amount of injury in another direction, for by removing the typhoid poison from our wells we have increased the risk of transferring it to our rivers.

Bacteriology has to a large extent cleared our minds regarding the causation of water-borne diseases, and it now appears to be fairly well established that although organisms survive for long periods in the soil, they die more or less rapidly in sewage and in rivers. We know also that by efficient filtration on a large scale towns may be protected from water epidemics, a fact of which we had practical proof a few years ago in the cholera epidemic in Hamburg. In a recent report to the London County Council by Mr. Parry Laws and Dr. Andrewes, the results of a special inquiry into this question are set forth, and the facts learned from numerous tests as to the presence of pathogenic bacteria in sewage and sewer air are given. The conclusions arrived at agree with those of previous observers as to the absence of pathogenic bacteria in sewer air, and, except in the case of sewage collected from the main drain of the Eastern Hospital at Homerton, where forty cases of enteric fever were under treatment, and where the disinfection of stools had purposely been discontinued for two days previously, they failed to find the bacillus typhosus by means of careful bacteriological analyses of many samples. Even sewage collected from a sewer at a point a quarter of a mile away from the hospital, and into which the hospital drain discharged, gave negative results.

The suggested explanation of this is the "mathematical improbability" of finding the bacillus, owing to the very large dilution of the excreta which takes place, and if it be a fact that the bacillus typhosus, in greatly reduced numbers it is true, can still be found in sewage which has been kept for as long as a fortnight, we may conclude that this explanation is the right one.

Most Medical Officers of Health can probably call to mind *examples* of serious pollutions which have not led to the

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calamitous consequences one might have reasonably anticipated they would have done. I may mention one example which occurred in my own experience. A comparatively small stream in Staffordshire receives the sewage of a population of nearly 500,000, after moderately satisfactory land treatment. During periods of rain, however, serious pollution of this stream takes place, owing to the direct discharge of untreated sewage, which, in consequence of the accumulated deposit in long sections of old sewers, is of the foulest description. This has led to the gradual formation of mud banks for miles down the stream, and within about fifteen miles, at a point where the stream traverses a flat country, and where until recently the tendency to flooding has been encouraged by weirs, the nuisance has become very serious. At this point there is a town of about 5,000 inhabitants in which many of the houses, until the recent removal of a weir, were periodically flooded by the foul water and sewage mud. Notwithstanding this fact, however, the town in question has not suffered exceptionally from typhoid fever—a circumstance which is certainly remarkable if the sewage-polluted water which inundated the cellars, and even extended to the ground floors of the houses, contained, as one would imagine it frequently must have done, the bacteria of typhoid, for it is almost inconceivable under such circumstances that food supplies could have escaped frequent contamination. Possibly the tendency to the decay of typhoid bacteria in sewage and streams may account for this.

On the other hand, recent experience has brought to light new dangers from pollution of streams. I refer to the part played by shell-fish as disseminators of cholera and typhoid. In the report of the medical officer of the Local Government Board, for 1894, strong suspicions were expressed that shell-fish from Grimsby and Cleethorpes had contributed to the diffusion of cholera in 1893, the explanation being the contamination of the shell-fish in sewage-polluted tidal rivers by the washing of the beds with every tide, in addition to the fact that oysters were actually stored in the docks. Dr. Newsholme of Brighton, in his last Annual Report, has also pointed out that sewage-contaminated oysters and other shell-fish were responsible for forty per cent. of the typhoid cases which originated in that town during 1894, the number of such cases being fifty-three.

It must also be remembered that although it may not always be possible to prove direct injury to human life from sewage-contaminated water, there is every probability that cattle suffer from consuming such water, hence the successful actions for damages which are frequently brought against authorities by riparian owners.

Be this as it may, however, it is contrary to law to pollute streams, and whether the incentive to action be the protection of human or animal life, or merely the determination that the law shall be observed, the fact remains that sewage must be purified before it is discharged into streams. Sir Benjamin Ward Richardson suggested some time ago that trunk sewers might be laid along the lines of railways to the sea coast, but such a scheme cannot be entertained as a practical solution of the difficulty, and each authority must be called upon to do all that is reasonably possible to purify their sewage locally.

I propose to occupy the remainder of the time at my disposal with a brief summary, based to a large extent upon practical experience, of the available means of accomplishing this.

In Staffordshire we have many sewage-disposal works—good, bad, and indifferent, and in the case of twenty-seven of these, and at thirteen points of observation on streams, samples of effluent and river water are regularly collected for analysis. This work has been going on systematically for three years, and I have now about 700 records which are kept in tabular form, together with particulars as to the rainfall the day before, the week before, and the month before the date on which the samples were collected, and the estimated flow of the stream at the time. So far as the figures are concerned, I have not yet had time to study them sufficiently to extract all the information they are no doubt capable of imparting, but it is evident that such records, together with others from other counties where the same work is being carried on, are likely to be of great and increasing value in the future. I have, however, formed general impressions from the analytical results during the progress of the work, and these, combined with information acquired by periodic inspections of the sewage-disposal works, have led me, rightly or wrongly, to arrive at fairly positive conclusions. It may perhaps conduce to a useful debate if I simply mention categorically the impressions I have formed, and, without much comment, indicate the direction in which useful inquiry may be conducted in order to elucidate certain points which at present are somewhat obscure. It must be understood, however, that I speak as a humble student and not as an authority on the subject.

My experience, then, has led me to the following conclusions:—

1. That the most satisfactory results are obtained by precipitation followed by land filtration, providing the land is suitable, and that it is properly prepared and efficiently managed.

2. In my opinion, the theory that because the nitrifying organisms are found chiefly on the surface, therefore the land

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drains need not be laid very deep, is a mistaken one, for, whatever the explanation may be, I invariably find that the best effluents are derived from land which is deep drained. In one town in Staffordshire a phenomenally good effluent is always produced by land where the effluent drains are from six to eight feet deep.

3. I believe that land if properly used will continue to do its work efficiently for an indefinite period; but if sewage in excess is applied to it, or if sufficient intervals for aëration are not provided for, the results will rapidly deteriorate, and a long rest will be necessary to enable the land to recover.

4. One common cause of failure is the needless volume of sewage which is received at the works during periods of rain, and in many instances this difficulty might easily be overcome if a separate system of sewers were established. It is not desirable that the sewage should be very concentrated, but the dilution should be effected not by the uncertain rainfall but by properly arranged flushing tanks.

5. It must be accepted as a principle that profit should be subservient to efficient disposal, and under no circumstances, in the case of works of any size, should sub-letting of the land to farmers be entertained. I know several examples of works where good effluents might be obtained were it not for this practice.

6. As regards artificial filtration, I think it is pretty generally admitted now that such substances as polarite and magnetone do not possess any specific power of disintegrating sewage by some mystic process, but that they act merely as air carriers, and so contribute to the growth and activity of the nitrifying organisms which, with proper use, develop in their interstices.

If this is the case it is quite a question whether the same results might not be obtained by ordinary sand filtration, and that they can appears to be established by the careful and exhaustive experiments which have been conducted by the Massachusetts State Board of Health. It is possible also that the efficiency of sand filtration may be increased by artificial aëration of the filters, although, as yet, we have nothing but experiments on a small scale to warrant this conclusion.

Time will not permit of any mention of other systems of disposal, but I believe that none will prove to be satisfactory which do not aim at producing as thorough nitrification as possible. Any system, and I could name more than one, which aims merely at the precipitation of the solids and the disinfection of the effluent, must prove a failure, for, even admitting that the effluent is aseptic as it leaves the works, a point will soon be reached when, by dilution, it will no longer be so, and

it will then yield up its organic matter to the putrefactive bacteria in the stream, and sludge will at once be formed.

One word regarding the chemical aspect of the question. We have much to learn before we can bring into line the chain of circumstances which will render intelligible the process by which the organic constituents of the sewage are transformed into more stable inorganic substances, but that the transformation must be reasonably complete in order to arrive at a good result there is little doubt. I would far rather see an effluent in which nitrates were largely present than one which showed imperfect nitrification, although containing less albuminoid ammonia. At the same time what should be aimed at, beyond simple clarification, is a highly nitrified effluent with a satisfactory reduction of organic matter, as shown by the absence of albuminoid ammonia in excess, and the small amount of oxygen absorbed; if the first requisite is fulfilled, the last two will probably be found to follow as a natural consequence.

I venture to suggest that future inquiry should be directed to a study of the nitrifying organisms, in order to arrive at as accurate a knowledge as possible of their life history. The results of chemical analyses must be considered in conjunction with the conditions of bacterial life in the soil or filter which has produced the effluent. Investigations as to the nature of the soil and its nitrifying power at different depths should be conducted, both by collecting samples of the soil for bacteriological tests, and by draining similar land at various depths, and analyzing the respective effluents. I have recently made a beginning on these lines, but I have not yet obtained sufficient facts upon which to base any conclusions.

The question of sewage-disposal, then, is an extremely technical one, and among the quicksands which beset authorities on their voyages of discovery to find the best solution of the problem, not the least dangerous are the alluring claims of plausible patentees, who, if forewarned of the visit, present tempting specimens of the sparkling effluent by the side of the sewage from which they are said to be derived, and who are prepared to go any length in undertaking to relieve authorities of their responsibilities if they will only adopt this or that special system. The question is a chemical as well as an engineering one, and local authorities would do well to be guided by disinterested and experienced advisers rather than run the risk of having their judgment obscured by irresponsible and interested persons. Money has been largely misspent in the past, and it is only by an intelligent appreciation of the valuable lessons which have thus been taught that similar mistakes may be avoided in the future.

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Professor H. Robinson (London) said he really had not intended to speak. The subject was too large to touch upon except in respect of one or two points. Those who, like himself, had had to do with sewage disposal for twenty or thirty years, would find so much to discuss that the difficulty would be to stop them once they had started on the subject. He would not say anything in reference to pollution of rivers and streams, but would confine his observations to that part of the paper with which he thoroughly agreed in reference to the interest presented by the study of the life history of microbes, these microbes playing a most important part in the solution of the difficulties attending the disposal of sewage. It was of more importance what had been done during the last ten years than in all previous time, the splendid researches of the State Board of Health of Massachusetts, following those of Warington, Munro and others, all pointed to the fact that what the engineer had to rely upon was the microbe in bringing about purification. At the present time the life history of this organism, or rather of these organisms (for there must be several), had been carefully studied. Some of them required much air, and others little or none. Their functions were not as yet thoroughly understood, or if understood by bacteriologists, their conclusions were not available. He hoped therefore that bacteriologists would pursue the matter and let them know more fully what these bacteria did, how they lived, what functions they discharged under the varying conditions in which they existed. It was very well known what they could do under certain conditions, but there were many problems in this connection which required elucidation. These problems would admit of solution in a very short time if men like Dr. Reid and others were to devote their attention to arriving at a clear idea of the way in which these organisms fulfil their functions. He did not altogether agree with the lecturer that the sand filter would solve the problem of sewage purification. What they wanted was large clean surfaces where these microbes could be developed and grow under circumstances suitable to their cultivation. Whether that was to be done by means of a sand filter, or with gravel or other filters with large surfaces, was a matter which had been the subject of much investigation. He apologised for offering these disjointed remarks in answer to the Chairman's invitation, and he regretted that the time at their disposal did not permit of their thrashing the subject out more thoroughly.

Dr. A. Whitelegge (Wakefield) said he fully realised the necessity of confining himself to one or two of the points which the subject comprised. His own experience had been gained in the West Riding of Yorkshire, where he had to look after about a thousand miles of more or less polluted rivers; and some of the West Riding rivers were, he thought, about the foulest in the Kingdom, and that was saying a good deal. He pointed out that the difficulty did not end when they had induced local authorities to construct efficient works, for a very great deal depended upon the maintenance of their efficiency. A number of them had no sewage

works at all, others only nominal sewage works, and very few indeed had hitherto turned out continuously a satisfactory effluent. Many only worked in the day-time, and not at all on Sundays, in blissful ignorance of the fact that there was sewage to be got rid of on Sundays as on other days. The West Riding River Board obtained a special Act conferring upon them powers of inspection. That had been a weak point in the old law, for under it the supervising authority had no right of entry on such premises to see whether the process of purification was being carried on efficiently or not. Those interested in the matter would at once recognise the necessity, not only of causing such works to be built, but to enforce their working at night and on Sundays. In the manufacturing districts their difficulties went far beyond domestic sewage. In the West Riding they had some very foul effluents from various manufacturing processes, and they were now confronted with the question whether this effluent ought to be allowed to go into the sewers, or whether the manufacturers should have separate outfalls. If from the engineering and chemical standpoint it was practicable that the trade effluent should be turned into the sewers and dealt with at the outfall, not only would the task of supervision be much easier, but the total cost to the community would be less. The Local Government Board had of late declined to sanction schemes for the drainage and sewage disposal of districts unless the manufacturers submitted their effluent to a preliminary treatment before passing them into the sewers. He then proceeded to discuss the alleged self-purification of streams. He had made a practice of analysing at intervals of a week or a month the streams into which all this foulness flowed. He found that the sum total of filth in the lower part of the river was by no means equal to the amount poured into the river and its tributaries higher up. It was easy to see, however, that this purification was mainly effected by the deposit of the filth on the banks and foreshore, and whenever the stream ran low they had the concentrated results of such filth accumulations.

Major Lamorock Flower (London) said that he spoke from long experience of a river out of which people drank—the River Lee—and he had to thank Dr. Reid for the very excellent way in which he had brought the subject before them, many of the points raised being of the utmost importance. Dr. Whitelegge had pointed to a matter of absolute necessity in the treatment of sewage and the purification of rivers. It was indispensable that these works should be kept up to a proper standard of efficiency by constant inspection. He knew many cases in which excellent sewage effluent had been produced in the early days of the works, but they had been handed over to a Committee of the Authorities, and not to Engineers, as they should have been, and then they were neglected, so that it might be said that the rates had been kept down. He observed that sewage farms had been very much abused. He contended that earth, as had been contended by Moses, was the best purifier of refuse, and he did *not think* they had gone much further in this direction since his

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time. He pointed out that sewage farms must be in proper positions, and the sewage must be delivered in a certain form at such farms; they must ascertain its composition before they could know the quantity of land required to deal with it. One of the difficulties was the large addition to the quantity of sewage that occurred in storm times when it amounted to a perfect flood; when that occurred the sewage flowed directly into the river. He said that in an area with 60,000 inhabitants they treated their sewage, or pretended to treat it, on a farm of 160 acres. They poured their sewage on to this place without any preparation whatever, and the result was of course abominable. He concurred in the view that the best mode of dealing with sewage was by precipitation and subsequent filtration through a suitable thickness of land. He had begun it many years ago, but they had foretold that he would never arrive at anything. He was, however, glad to find that Dr. Reid was also of opinion that it was the best. With regard to the pollution and purification of rivers, no notice had been taken of the abominations which got into the smaller tributaries, and were left there to putrefy until a heavy storm washed them down into the main stream. He thought a constant system of perfect inspection would unquestionably prove of material assistance in effecting the purification of rivers.

Mr. J. Wallace Peggs (Christchurch) said he wished to refer to a case of river pollution in which he had taken some interest during the last year or two. He was referring to southern rivers, the Stour and the Avon, both of them salmon rivers with public fisheries of great value. It had been the custom of the Town Council of Christchurch to take the sewage from the town by flat, badly-constructed sewers, delivering the raw sewage into the rivers without any treatment. This had gone on until about two years ago, when, by the construction of additional sewers, the matter came prominently forward. They were able to deal with this question of pollution in the following way and bring it home to the authorities. A strong committee, of which he had the honour of acting as honorary secretary, was appointed locally, and by working away at the question they were enabled to memorialise the Local Government Board, and thus obtained an order for an enquiry at Christchurch. That Local Government Board enquiry was held by General Crozier, R.E., and the report was entirely in favour of the committee. He mentioned this just to show how the southern rivers had been dealt with, but that was a comparatively simple matter compared to the rivers alluded to by Dr. Reid and Dr. Whitelegge. The interest arising from the rivers Stour and Avon was that the rivers at the point in question were tidal, that is to say, the fresh water was pushed up by the rising tide. That was a difficult matter because it did not come quite within the Rivers Pollution Prevention Act. Then again the "double tides" which occurred, give a very slight rise and fall of the rivers, and therefore a very small scouring action. He agreed as to the separation of rainfall from sewage, and he believed that that was the only scientific way of treating town

sewage, especially when it had to be lifted by pumping and taken on to the land. He concurred in what Major Flower had said as to the pollution going on in the tributary rivulets, which he thought should be more systematically looked after, and which he thought should be seen to in any future legislation on this subject; he would refer more particularly to the small pollutions from mansions, farmsteads, cottages, and foul ditches. Above all they must have an Act that was workable. Dr. Ashby, the Medical Officer of Health for Reading, had stated before the Royal Commission on Metropolitan Water Supply, 1893, that the Rivers Pollution Prevention Act has been more or less a dead letter all through the country. He concluded by expressing the hope that a really workable Act would be obtained soon, and that The Sanitary Institute would have an opportunity of helping forward such Bill in the future.

Mr. W. D. Scott Moncrieff (London) said that they were very much indebted to the lecturer for his interesting and suggestive paper. Looking at Dr. Reid's remarks as a whole, one could read between the lines so far as to see that he felt, like everyone else who had thought seriously on the question, that the subject of river purification was just now in a transitional state. In England it was difficult to say what the line of divergence between the old and the new was likely to take. In Germany the difficulty of river pollution had received much attention, and was just now in a very acute form. There was a strong line of demarcation between the scientists of North and of South Germany. So far, the action of the German Imperial Authorities had been the same as that of the Local Government Board in England, that is to say, there was a rising demand for definite provisions in respect of the pollution of streams. In the North these requirements had taken a chemical direction, but there were objections in South Germany as to the limits which were being set as to what might or might not be passed into the rivers.

Many years ago, Pettenkofer had carried out certain investigations in respect of the self-purifying power of the River Iser. Being himself a chemist, he had handed over the bacteriological investigation to Prof. Buchner. It had been stated that the Iser was capable of purifying by some internal process the discharge of sewage from the town of Munich, with its 300,000 inhabitants, so completely, that a mile or two further down there was no pollution at all. Of course a great many arguments might be founded upon an experience of that kind, but the conclusions arrived at would be somewhat misleading if applied to different conditions. In the first place the volume of the Iser in proportion to the volume of sewage was enormous. Recently Munich had been sewered, and was being fitted up with all the appliances of modern sanitation, consequently the discharge of sewage into the Iser would be greatly increased. Even that was accepted by the South German school of bacteriologists, who asserted that the river would be capable of dealing with the sewage of a town of 500,000 inhabitants. The Iser was a large stream and it contained a great amount of suspended mineral matter which was more or less

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alkaline, and he suggested that this suspended matter would no doubt act very favourably on the bacteriological activity of the river in providing rafts for the working of microbes and facilitating their growth.

In Berlin the chemists were laying down hard and fast rules with regard to the small amount of pollution that would be allowed to pass into rivers, while on the other hand the school of bacteriologists referred to were maintaining that streams were capable of dealing with a very much greater amount of organic matter than chemists supposed possible. He observed that it was very necessary for people in England to have a clear idea of the functions streams were expected to perform. He took two extreme cases, one a clear stream passing over igneous rocks, possessed of very low bacteriological activity, and on the other hand streams which were nothing more and nothing less than open sewers. Clear highland streams did not offer the best conditions for self purification, because organic impurities thrown into them would probably remain unbroken up for a very much longer time than in the case of rivers in a high bacteriological state of activity running through agricultural land. It might be laid down as a general rule that, putting aside outlying streams in valleys where there were no human habitations, what between land filtration and land manuring, it was inevitable that rivers should be contaminated. He did not think a river like the Thames could ever be made chemically or bacteriologically pure, and he thought it would be a great disadvantage if it were. It really came to this, first, what is the proper relation between the volume of a stream and the amount of contamination it received in relation to its bacteriological activity. If the stream were overladen with organic matter, there would be a growth of fungi which would retard or destroy its purifying power. It was possible to have a stream so polluted that its use as a purifying agent became altogether eliminated. On the other hand, they might safely discharge into a small but not over-worked stream an amount of organic impurity which would be quite beyond the power of a larger but over-polluted river to deal with.

When Dr. Reid spoke of the relation of pollution to bacteriology, he alluded to nitrifying organisms as being the principal agents of purification. That was perfectly true, nitrification being the final form which the highly complex substances assumed. He would, however, like to ask what was meant by a nitrifying organism? The organisms which effected the greater part of the conversion, and which were always ready to hand for the breaking up of organic matter into its harmless constituents, such as the protean group and the Bacillus Subtilis, were only nitrifying organisms in a contributory sense. He questioned very much whether there were organisms that were capable of directly nitrifying organic matter under ordinary conditions. Organisms of liquifaction changed organic matter but did not nitrify it, and this process should be carried out before making use of the streams where final nitrification took place by means of strictly nitrifying organisms. Dr. Reid had not referred

to the recent experiments of Mr. Dibdin, at Barking, who had done some extremely interesting and courageous work. He hoped that the general tendency would be to work in the direction of nature, and not by any chemical process which retarded bacteriological efficiency.

Mr. R. F. Grantham (London) said he had no difficulty in recognising the town of 500,000 inhabitants to which Dr. Reid had referred, and he was in a position to testify to the extent of the mud banks lower down the river to which he had alluded, due no doubt to the deposit from the effluent sewage from the town. It was very desirable to prevent the formation of such mud banks by a more efficient purification of the effluent. With regard to artificial filtration through sand, he might perhaps enter a little on the point alluded to by Mr. Scott Moncrieff, viz., Mr. Dibdin's report to the London County Council on artificial filtration. Mr. Dibdin had tried five materials: pea gravel, sand, burnt ballast, what is called the proprietary material, and coke breeze. After several months' experimenting he had found that sand was too fine, and ballast rather too coarse, and of all the materials coke breeze three feet thick gave the best effluent. He came to the conclusion, after laying out an acre of this material, that he could purify a million gallons in twenty-four hours, from which he inferred that 180 acres of it would be sufficient to purify all the sewage of London. It was presumed, of course, that lime would first be used to precipitate the matters in suspension. He did not suppose that Prof. Robinson wished them to consider all the literature of the last fifteen years on the subject as useless, because, although they were finding out the causes that produced the effects, many of the recommendations made in past years held good now. For instance, Dr. Frankland's suggestion as to intermittent filtration, they had no doubt learned much about it, but he did not think it could be improved upon. He pointed out that a Rivers Pollution Act had been three years before Parliament without having been carried through. That Bill was founded on the Act that had been passed in respect to the Mersey and Irwell. The Mersey and Irwell Committee's Act and the West Riding of Yorkshire Rivers Board's Act had and would be productive of much good. Sir Henry Roscoe had said in evidence he had no doubt in his experience in the Mersey and Irwell that there was some practicable method of dealing with all kinds of trade refuse. The method of dealing with the refuse by the manufacturers individually was a very difficult question. If, on the other hand, they turned the refuse into the sewers it became very difficult to deal with, unless the chemists could come to their assistance. It was evident that an engineer must have great difficulty in dealing with an effluent from such various sources seeing that it varied from hour to hour, and one could never tell beforehand whether it would be acid or alkaline.

Dr. G. Reid (Stafford) in reply pointed out that the filter need not *necessarily* be sand. When he spoke of sand, he included gravel of

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various sized particles, probably it did not matter whether they used sand or any other substance, provided the filter was permeated with air and it enabled bacteria to grow in contact with the sewage. With reference to trade effluents mentioned by Dr. Whitelegge, he said he had had no experience of such, so that he had no grounds to go upon from a practical point of view. Dr. Whitelegge had also referred to the idea held by some that sewage may under certain circumstances be turned into streams in consequence of their self-purifying powers. He had gathered that he objected very strongly to this practice in consequence of what took place afterwards. Mr. Scott Moncrieff had also referred to the question, implying apparently that it might be a permissible proceeding. So far as Staffordshire was concerned he did not think it contained what might be called a self-purifying stream, except perhaps in districts where there was no sewage to turn into them. To be self-purifying it must contain oxygen, and he did not think they could find many polluted streams which contained much oxygen. With regard to the principle itself, he asked whether it was a fair proceeding to handicap towns lower down the stream by turning into it sewage at a higher level. By so doing they abstracted to some extent the power of the river to purify itself, so that he did not think it was a fair proceeding. Major Flower thought earth was the best purifier, and this was doubtless the case. He had had experience of sand filters, which however were not properly managed, and also of polarite filters, but even from the latter he had not succeeded in obtaining anything like so good an effluent as from a well-managed land filtration scheme with deep effluent drains. With regard to coke breeze as a solution of the difficulty, he would like to be able to believe that it was going to relieve them of the difficulties of sewage disposal at the rate of one acre to a million inhabitants. He did not suppose there was any particular virtue in coke breeze, except that it was a convenient material for bacterial growth, and, consequently, nitrification. If coke breeze could do this there were possibly other substances better available to the various towns by which the same result might be achieved.

Sir Douglas Galton (London) said the most satisfactory part of the discussion was that it made them feel that they were approaching the solution of the sewage question. It was evident from the experiments which chemists had made, with the assistance of the biologist and the engineer, that they would shortly be able to devise a means which would return the water of the sewage in a comparatively inocuous form into the streams. In respect of river pollution, he pointed out that the first Act of Parliament had been passed under great difficulties. It had been very strongly opposed, and the various restrictions that had been put into it had really made it quite unworkable for good. Since that time the public had become better educated in respect to keeping rivers clean, and the next Act of Parliament would probably be a more efficient one. In respect of the question of the pollution of the stream, he pointed out that

when they got into country districts where there were large villages, with all sorts and conditions of sewers, they must go still further back in the question of purification, and they must not allow the ditches which surround farms and villages to be filled with a quantity of impure matter, which was of course washed down into the stream when there was much rain. They had found great difficulty in this respect in his own county of Worcestershire, to which attention was constantly being called by the County Medical Officer, who pointed out that he had no means of preventing the contamination of streams which ought to be perfectly clean. He thought that any future Act ought to contain conditions which would assist rural sanitary officers in this matter.

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THE BACTERIAL PURIFICATION OF WATER.

By Professor Percy Frankland, Ph.D., B.Sc., F.R.S.,

Professor of Chemistry in Mason College, Birmingham.

Read at the Reception of Members of the British Medical Association by the Institute on August 2nd, 1895.

It is but little more than ten years ago that Robert Koch first published his beautiful and comparatively simple methods for the study of bacteria, and although their application to water was in the first instance regarded as of subsidiary interest in comparison with their use in the direct study of the problems of disease, yet it must now be obvious to all that a new era in the study of water purification was really inaugurated when these methods were first applied to the bacteriological examination of water.

It is not necessary for me here to enter into the germ theory of zymotic disease, and the possibility of infectious maladies being communicated by means of water. These are now accepted facts, but it was the early interweaving of these theories with the hygiene of potable water that not unnaturally led those connected with the sanitary aspects of our water supplies to embrace the opportunity thus afforded for the first time of gaining an insight into the actual microbial condition of water from various sources, and submitted to various processes of purification both natural and artificial.

Amongst the most important of the natural agencies for which it was desirable to determine the purifying power as regards the elimination of bacterial life, was the filtration which water undergoes in passing through great thicknesses of porous strata, as in the case of deep well and spring water; again, the action of the flow of rivers and streams on the bacterial life present in them; again, the effect of sedimentation in large water-basins, and the action of sunshine on the micro-organisms of water.

A large number of investigations have been made in all

these several directions, but I cannot do more than briefly indicate the results which have been obtained, and the general conclusions which have been drawn from them.

That deep-well waters possess a very high degree of bacterial purity is shown by the very small number of micro-organisms found in them. Thus, in my bacteriological examinations of the London Water Supply for the Local Government Board, which I commenced in the year 1885, I repeatedly found numbers under 10 per cubic centimetre; and similar results have been obtained with similar waters by other investigators, both at home and abroad. To appreciate the smallness of the numbers found in these deep-well waters, it must be borne in mind that surface water, such as that of the Thames at the intakes of the London Water Companies, may contain from 1,000 to 120,000 microbes per cubic centimetre.

As regards the changes in the bacterial contents of river water during its flow, I had a particularly favourable opportunity some years ago of studying this point in connection with the River Dee, in which my examination extended over a distance of upwards of 40 miles. Above Braemar the Dee was found to yield only 88 microbes per c.c.; after receiving the sewage at Braemar, however, the number went up to 2,829 per c.c., whilst some miles further down the number had fallen to 1,139; below another point where some more sewage had gained access the number rose to 3,780, whilst some miles further down it again fell to 938; with fresh access of sewage it rose to 1,860 per c.c., lower down again falling to 950 microbes per c.c. The River Dee thus affords a most striking example of repeated pollution and repeated restoration of a stream to a state of comparative bacterial purity. But one of the most interesting features of this experiment was the circumstance that the absolute amount of polluting material gaining access to the stream at the several points was so small that it was not detectable by chemical analysis at all, although so distinctly indicated by the far more delicate bacteriological examination.

Another factor demanding investigation was the effect of sedimentation in large water-basins on the bacteria present. That such sedimentation has the effect of largely diminishing the number of bacteria suspended in the water was probable, from laboratory experiments which I made on this subject ten years ago, and also from the fact that the water of the ocean and of large lakes is generally found to be only sparsely populated with bacteria. In collecting evidence to bring before the recent Royal Commission on the London Water Supply, I had the opportunity of approaching this important question of sedimentation more closely on a large practical scale, by making numerous

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experiments at the storage reservoirs of the several London Water Companies. These experiments showed that storage in subsiding reservoirs is of very great value, not only because it enables the companies to abstain from taking water when the rivers are in flood and otherwise in bad condition, but also on account of the remarkable removal of micro-organisms which takes place in the process.

Thus the following concrete example, selected at random. well illustrates this point:—

At the West Middlesex Company's works the Thames water at the intake contained 1,437 bacteria per c.c., whilst after passing through one storage reservoir the number present was only 318, and after passing through a second reservoir it had fallen to the astonishingly low figure of 177 per c.c.

These figures are sufficient to indicate in a very striking way how the adequate storage of water diminishes the risk of pathogenic organisms which may have been originally present, remaining in suspension after this process of subsidence has taken place. In the case of many water supplies, especially those from moorland sources, this storage is in fact the only process of purification to which the water is subjected. Thus the Loch Katrine water supplied to Glasgow, as well as the water supplied to most of the towns in the north of England, is submitted to no purification process beyond this storage in reservoirs of vast size.

More recently, Sunshine has been brought forward as a responsible agent for the destruction of bacteria in water. The lethal action of the sun's rays on bacteria, whether suspended in water or in other transparent media, was discovered nearly twenty years ago, and is altogether beyond question; but whilst allowing full credit to this agency for what it can accomplish, there is no doubt that its power of bacterial purification is limited to the upper layers of water, and that as a rule in this country we cannot place much reliance upon it, even for this share in water purification, for unfortunately the abundant sunshine, which we have enjoyed during the past spring and much of the present summer, is assuredly altogether exceptional in these islands.

It is, moreover, a very difficult factor to disassociate from other factors in actual practice, thus I should hesitate to attribute the greater freedom from bacteria, which I have frequently found is exhibited by the Thames and Lee in the summer than in the winter months, to the greater power of the sun's rays during summer; on the contrary, it is obvious that there are other causes tending to bring about this inequality in the bacterial life during summer and winter, for we know

that in summer these rivers are largely composed of spring water which naturally contains but few bacteria, whilst during the winter months the water in the rivers is to a great extent derived from surface sources in which bacterial life is extremely abundant.

Bacterial Purification by Filtration.

The bacteriological examination of water has rendered even greater service in revealing the hygienic value of the various artificial methods of water purification which are in actual use.

That surface water, in becoming spring and deep-well water, undergoes a process of radical purification has been long established by chemical analysis, which almost invariably discloses the fact that such deep-well and spring waters contain but the merest traces of organic matter; the discovery of the simultaneous almost complete absence of bacteria in these waters was, therefore, not a matter for much surprise.

On the other hand, certain artificial processes of purification, when submitted to chemical investigation, have been found to possess little or no efficiency in the removal of dissolved organic impurities in water. This is notably the case with sand filtration, which is the commonest form of purification to which water is subjected on a large scale.

For upwards of fifty years this sand filtration, initiated by Simpson at the Chelsea Waterworks in 1839, has been practised at an increasing number of places where more or less turbid water has to be dealt with. Chemists have, however, generally regarded this process with but little favour, in consequence of the very indifferent purification, which, from a chemical point of view, it accomplishes; so when the bacteriological examination of water became available, it was obviously a matter of the first importance to ascertain whether the purification effected was equally indifferent also, from a bacteriological point of view. The investigation of this matter, which I commenced in 1885 on the London Waterworks, the largest filtration works in the world, led to some very surprising results, which are of great practical importance, for I found that whilst these sand-filters are chemically comparatively inert, they are superior to almost all other filters hitherto devised in their extraordinary power of removing bacteria.

Already, in the year 1886, from my experiments at the London Waterworks I was able to indicate, in a paper which I read before the Institution of Civil Engineers, the following as the guiding principles on which this sand-filtration of water *should* be conducted:—

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(1) To ensure the maximum storage for unfiltered water.
(2) To filter at a minimum rate.
(3) To have the maximum depth of fine sand.
(4) To frequently renew the filtering materials.

The last-mentioned principle requires some qualification by the light of further investigations, for knowing as we now do that the efficiency of the filtration is principally due to the production of a layer of slimy silt on the surface of the sand, and which takes some time to form, it is theoretically desirable to continue the filtration through the filter as long as possible, as after cleaning, the action of the filter will at first be very imperfect until the layer of silt has re-formed. In actual practice, however, inasmuch as a certain volume of filtered water *must* be furnished daily, the long-continued use of such filters without cleaning will inevitably lead to very high pressures being employed or more rapid filtration through some of the filter-beds—circumstances which experience has shown materially interfere with the efficiency. There is, moreover, a tendency at the present time to attribute too exclusive an importance to the formation of this surface slime, and to ignore the depth of the fine sand employed. Recent investigations have shown that even after passing through this layer of surface slime, very considerable numbers of bacteria still remain in the filtrate, and that to obtain a satisfactory filtrate it is essential that the water should pass through a layer of sand not less than 15 to 24 inches in depth. It is, moreover, of importance to hasten the formation of surface slime, and to this end the water should be run on to the filters and left there undisturbed for twelve hours before filtration is actually commenced. It is highly desirable also that the filtrate obtained during the first twenty-four hours or so should not be supplied for consumption, as the efficiency of the filter will not be established for a few days.

I have frequently experienced great difficulty in obtaining samples of the filtrate from individual filter-beds, as in their original construction no provision was made for such a purpose. It is, however, of great importance that there should be facilities for the collection of representative samples of the water coming from filter-beds, as only in this way can the working of each individual filter-bed be investigated; and in the event of the filtrate proving unsatisfactory, it should be excluded so as not to interfere with the standard quality of the general supply.

It may be remembered that Koch ascribed a remarkable recrudescence of cholera in Altona, after the great Hamburg epidemic, to one of the sand-filters having been rendered

inefficient by the frost, the imperfection in this filter-bed not having been discovered until its filtrate had contaminated the whole supply.

Purification by Precipitation.

Of other processes of water purification I need only mention agitation of water with solid particles, such as finely divided iron, followed by subsidence, and the precipitation of water by means of lime, alum, &c. The most important of these is the precipitation by means of lime, as practised in the softening of water by Clark's process. On examining such water before and after softening, I have repeatedly found that the bacteria are removed to the extent of from 98 to 99 per cent. In this simple process, therefore, we must recognise a very valuable means of purifying water from bacteria.

Household Filters.

For the purification of water in the house numerous filters have been offered to the public, the most modern being those in which the water is made to pass through unglazed porcelain or baked infusorial earth. But although these filters in the first instance remove all bacteria, they rapidly lose this power, and a filter which will continue to remove all bacteria for weeks or even months, has yet to be discovered. In the meantime, therefore, the only reliable way of sterilizing water for domestic use is to submit it to boiling, after which it may with advantage be passed through a filter to render it more palatable.

Pathogenic Bacteria in Water.

In conclusion I have a few words to say on the behaviour of pathogenic bacteria in different kinds of water, in sterile and unsterile water, in water bacterially pure and bacterially impure.

Whilst pathogenic bacteria have only on comparatively rare occasions been actually discovered in natural waters, a very large number of experiments have been made in which their behaviour in water has been investigated by purposely introducing them into waters of different kinds.

A number of most interesting and hygienically important results have been obtained in researches of this kind, which I cannot do more than very briefly summarize here.

Firstly, the pathogenic bacteria do not in general undergo any extensive numerical multiplication in potable waters, although some forms may multiply abundantly in sewage.

On the other hand, many pathogenic bacteria can retain

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their vitality in potable waters for long periods of time (days, weeks, and months), whilst in the case of those forms which give rise to spores, the vitality and virulence of the latter may persist for years. Some pathogenic bacteria, again, are very rapidly destroyed in water, although this mode of behaviour is decidedly exceptional.

Of the greatest importance in connection with the vitality of pathogenic bacteria in water is the condition of the latter as to whether it is sterile or non-sterile. In sterile water the longevity of pathogenic bacteria is generally greater, often much greater, than in natural waters containing the ordinary water bacteria. These common water bacteria are indeed even prejudicial to the vitality of pathogenic spores; thus I have found that if anthrax spores be introduced into water previously rendered sterile, either by boiling or filtration, the spores are present in undiminished numbers and possessed of undiminished virulence after upwards of seven months, whilst in unsterilised water, in some cases, they were actually destroyed in this time, and in all cases they were much reduced in numbers and virulence.

Another important point to which regard must be paid in the conduct of such experiments is the temperature at which the water is maintained. Thus I have recently found when investigating the behaviour of *sporeless* anthrax, as derived from the blood of animals dead of anthrax, that in sterilised water the anthrax bacilli were destroyed in about five days at 5° C., in fourteen days at 13° C., but that at 19° C. they multiplied enormously, and were present in large numbers on the forty-second day. This different behaviour was found to be due to the bacilli having formed spores in the water at the higher temperature. The danger of anthrax virus which has gained access to water depends, therefore, on the temperature of the water, and on the presence or absence of spores in the morbific material.

Yet another factor in estimating the vitality of bacteria in artificial surroundings remains to be considered, and that is the access of direct sunshine, for even anthrax spores, which are possessed of such striking powers of endurance under a great variety of adverse circumstances, may be destroyed by direct insolation in the course of a few hours. From experiments which I have made, however, on the action of sunshine on anthrax spores, it appears that they are less rapidly acted upon by direct insolation when immersed in water than when exposed to the same agency in ordinary culture materials; thus in some cases I have seen them endure as much as 100 hours' insolation in water, whilst in ordinary culture media their destruction has

been effected in from thirty minutes to seven hours. These results again indicate that we must not place too much reliance on sunshine as a bactericidal agency, at any rate in connection with the purification of water.

As regards the vitality of pathogenic bacteria in the presence of ordinary harmless micro-organisms of water, I may briefly refer to some investigations which I have recently made on the behaviour of the typhoid bacillus in waters of very different chemical composition, and when used in a sterile and unsterile condition respectively.

For the purposes of these experiments I selected examples of the three most representative types of water-supply, viz.: the water supplied to Glasgow from Loch Katrine; the chalk-well water of the Kent Company; and the Thames water, as abstracted from the river by the London companies. I had thus three widely different kinds of water: firstly, a surface water, containing practically nothing but vegetable organic matter; secondly, a water which had undergone exhaustive filtration through porous strata, and almost entirely free from organic matter; and, thirdly, an ordinary river water, with its organic matter derived from both vegetable and animal sources. Into a given quantity of each of these three different kinds of water the same number of typhoid bacilli was simultaneously introduced, and the fate of these bacilli was then followed, and the length of time they remained alive in each kind of water determined.

The typhoid bacilli which had been introduced into—

(1) Thames water which had been previously sterilised by heat remained alive for upwards of 32 days.

(2) Loch Katrine water which had been previously sterilised by heat remained alive for upwards of 51 days.

(3) Deep-well water which had been previously sterilised by heat remained alive for between 20 and 32 days.

On the other hand, the typhoid bacilli which had been introduced into—

(*a*) Thames water in its natural unsterile state remained alive for 9 days.

(*b*) Loch Katrine water in its unsterile state remained alive for 19 days.

(*c*) Deep-well water in its natural unsterile state remained alive for 33 days.

Thus in the previously sterilised waters, the vital persistence of the typhoid bacilli was greatest in the Loch Katrine and least in the deep-well water. The factor apparently determining longevity in the case of these sterilised waters was the *proportion* of organic matter present in them, which is of course

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much greater in the case of Loch Katrine and Thames, than in that of the deep-well water.

On the other hand, in the unsterilised waters, the factor determining longevity must be an entirely different one, for the typhoid bacilli remained alive for the longest time in the deep-well, and for the shortest time in the Thames water.

It is often supposed that the more rapid destruction of pathogenic bacteria in unsterile than in sterile water is due to a struggle for existence taking place between the pathogenic and the common water-bacteria in which the latter are often said to devour the former. That this is, however, an erroneous interpretation of the facts, is seen from the circumstance that in the deep-well water in which the vitality of the typhoid bacilli was the most prolonged, the common water-bacteria multiplied far more extensively than did those in the Thames water, whilst in the Loch Katrine water not only did no multiplication of the water-bacteria take place, but they actually declined in numbers.

To what then can be attributed the antagonistic action of the unsterile surface waters on the typhoid bacillus? These experimental observations, in my opinion, indicate that the greater antagonism of the surface waters is due to these waters, and especially the Thames water, having in their natural condition already supported countless generations of water-bacteria, which have led to the accumulation in these waters of chemical products which are prejudicial to the typhoid bacillus; on the other hand, the deep-well water is in its natural condition not only practically free from bacteria, but it has in its previous history also had no contact with micro-organisms, and hence it does not either contain any of those bacterial products which are present in the surface waters, and which appear to be so antagonistic to the vitality of the typhoid bacillus.

These antagonistic bacterial products are destroyed by boiling, for the life of the typhoid bacillus is much prolonged, as we have seen in boiled Thames and Loch Katrine waters, whilst the deep-well water not having any antagonistic bacterial products in it to be destroyed is not rendered more propitious to the vitality of the typhoid bacillus by boiling.

The hygienic importance of these results is sufficiently obvious, showing as they do that whilst typhoid bacilli can be conveyed in a living state by all forms of potable water, the danger of such conveyance taking place is greater in the case of underground waters normally destitute of bacteria than in that of surface waters which always maintain an abundance of harmless microbes. The danger of the conveyance of typhoid bacilli by the underground waters is further enhanced by the

fact that such waters are generally supplied without previous storage, whilst the surface waters, on the contrary, are rarely distributed for consumption until they have remained for a shorter or longer period in impounding reservoirs where the antagonistic action of the water-bacteria can come into play.

Sir George Humphry (Cambridge) said that during the time the lecturer had been speaking, his mind had been running upon the text of the excellent sermon which the Archbishop of Canterbury had preached at the opening of the British Medical Association Meeting, "A pure river of water of life, clear as crystal, proceeding out of the throne of God." They had learned from Prof. Frankland that a large amount of the clear water of life, typical of that in the vision of St. John and proceeding from the same source, was still to be found in the streams of the earth, and the further they went from the abode of man, the deeper they delved into the ground, the purer were the streams. Man, it seems, is the great contaminator of these streams, and he thought it followed as a consequence that one of the first duties of man was to endeavour to free the water from the impurities which he had been the means of introducing, to free it from the evils which he had communicated to it. He need not say that they were greatly indebted to the lecturer for the lucid and interesting account of the means by which this end may be, in some measure at least, attained, and he would ask those present for any observations they might have to make or any questions they might wish to put.

A question was asked as to whether the depth of the water had any effect upon bacteria.

Prof. H. Robinson (London) said that those who had to advise on this matter had to search through a number of blue and other books to ascertain their facts, and he thanked the lecturer for having brought before the meeting in so admirable and concise a form some of the more important points which had been brought forward during the last twenty-five years. He would refer to one point because it would set at rest the alarmist notions, that when a stream or source of water was once polluted, it was always polluted. This was not the place to discuss the question of the water supply for the metropolis, but the reason why the water supply of London was pure after storing, while it was slightly impure before, was of importance both to engineers and the public. Most of them had been more or less in dread of being liable to receive in their houses a contaminated water which might bring illness and trouble into their homes. The paper to which they had just listened must have done much to alleviate that feeling of anxiety. He felt very glad indeed to hear these reasons assigned by Professor Frankland, as about twelve years ago he had read a paper in this hall arriving at the same conclusions, though he did not then know what the causes

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were. He felt at that time that the practical evidence afforded by the absence of disease from the supply of water in certain quarters, although it was known to have received sewage pollution, pointed to there being some cause in operation to remove the pollution. The interesting paper to which they had just listened, and the valuable book of the lecturer which everyone read with pleasure and profit, gave an explanation of these beautiful processes of nature—processes which in their result rendered us less liable to disease from running streams, and less obliged to go long distances for pure moorland water than was often insisted upon.

Major LAMOROCK FLOWER (London) said he was very proud to be connected with the duty of making that "river of the water of life," of which their Chairman had spoken so eloquently, free from contamination by man. The researches which the lecturer and his father had made were most valuable in that they restored a certain amount of faith in the water we had to drink. He did not think people were so badly off in London, or in England generally, for water, and all the stir that was being made did no good whatever. He had done his best to keep a very large proportion of the water supply of London pure, and he had been one of the first to lay down the new filter beds in 1852 for the New River Co.

Dr. WM. OLDRIGHT (Toronto) said there were one or two points of special interest to himself as confirming certain observations which had fallen under his notice. The first point was with regard to the reversal of their former opinions as to the filtration of water. Formerly their great object was to remove the top of the filter beds as often as possible, but the lecturer had pointed out that that was a mistake, and that there was an advantage in not changing the surface too often. The result of his investigations had been confirmed in Massachusetts, where they had found that when the filter beds were first put in, the number of bacteria greatly increased, though at Lawrence, where they had formerly had much typhoid, the filter beds now, under ordinary circumstances strained out 98 per cent. of the bacteria. He said he would allude to an example of the folly that was sometimes shown in connection with the filtration of water. They had at Toronto, from Lake Ontario, one of the purest water supplies in the world. A Water Commission was appointed nearly thirty years ago, and in order to make the water purer still (?) they put a filtering reservoir on an island about two miles to the south of the City. There was a sort of horse-shoe peninsula with two gaps in it, and the pipes ran across the bay to this island, and a filter bed was then dug in the island. After a time it was found that the water from the lagoons was just as ready to run into the reservoir as the water of the lake, and they had a good deal of trouble in getting rid of this filtering basin, and running a pipe out beyond, into the deep water of the lake. He had always thought that the typhoid (among the pathogenic bacilli) would multiply more rapidly in sewage-polluted water than in ordinary water (even

though containing non-pathogenic bacteria). He had been surprised to hear in a paper yesterday that this was not the case, and was glad to hear the lecturer of to-day controvert the view expressed in the paper referred to. He would like to ask what admixture of sewage with the water was sufficient to enable the typhoid bacillus to multiply more rapidly. He also asked how long it would take for these bacilli to disappear in water with 1 in 500 of sewage in a flowing river. That point came up in a practical way before a Sewage Commission, before which he had been called upon to give evidence. It was understood that the diphtheria bacillus did not live long in water, and this concurred with his own view. He asked what influence sunlight had on the typhoid bacillus, and as to whether the presence of vegetable matter was favourable or otherwise to the multiplication of the typhoid bacillus.

Sir DOUGLAS GALTON asked whether all these bacteria were really dangerous to health, in other words, were they pathogenic? or might some of them be advantageous, in that they destroyed each other to some extent? He asked when they made a chemical analysis of water, whether the proportion of organic matter discovered, comprised that due to the presence of these organisms? Lastly, whether the presence of bacteria not directly injurious to health constituted a disadvantage?

A question was asked whether the lecturer in his remarks included Pasteur and Berkefeld filters, and how long they would remain perfect.

Mr. C. H. SOPER (London) presumed that the water alluded to was taken from the pipes before its entrance into the house, and said it was possible for pure water to become contaminated after it had reached the house. He alluded to the possibility of contamination in cisterns, and observed that while the front door-step was cleaned every morning, the cistern was often not cleaned once a year. That being so, he suggested that a great responsibility rested upon the occupiers of houses to have their cisterns regularly cleaned.

Surgeon-General DE RENZY (Ealing) said he could confirm most of the remarks made by the previous speaker. It was well known that the city of Dublin has one of the best water supplies in the world, but it was also a painful fact that typhoid fever prevailed in that city to an immense extent, indeed, it has been stated on medical authority that the amount of typhoid fever had increased since the introduction of the pure water supply. Sometime since he had been curious to ascertain the explanation of this striking paradox. He had found that it was largely due to the mode in which the water was supplied to the household. In most of the houses let in tenements the water was stored in the room in an open bucket. In this room from four to eight children might be sleeping, and when thirsty they would go to the pail and put their dirty fingers into it. That alone would explain the prevalence of the disease, although the water was brought almost to the door-step as pure as it could possibly be.

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Dr. J. GROVES (Isle of Wight) asked for an explanation of the long life of organisms in deep-well water as compared with river water, and whether it was due to the non-possession of qualities inimical to the life of such organisms, which river water may have. Was it possible that the abundant, innocent micro-organisms of river water produced toxins which killed the pathogenic organisms and immunised the water? If so, the bearing of the question of the life of pathogenic organisms in river water upon immunism generally was of the utmost interest and importance.

Dr. A. T. GUBB (London) alluding to the fact that the number of organisms was apparently taken as a measure of the impurity of a given sample of drinking water, asked whether, apart from micro-organisms, there might not be present other forms of impurity likely to be prejudicial to health? He asked further whether the removal of the organisms by filtration necessarily implied that a polluted water had been rendered potable, particularly as many bacteria secreted soluble products which would not be removed by filtration?

Sir GEORGE HUMPHRY (Cambridge) commented on the remarks made by the last speaker, and pointed out that as mischievous people had a tendency to quarrel amongst themselves, so it seems that bacteria often exercise a deleterious power on each other. That would explain why it was that the typhoid bacillus flourished and propagated in the deeper and otherwise less contaminated springs because there were few enemies to attack and destroy it, whereas in superficial water the typhoid germs encountered and became the victims of the other organisms which abounded there. It was further to be remarked that bacteria not only destroyed others but they also, some of them at least, emitted secretions which were prejudicial to themselves, and in this way afforded a certain measure of protection against themselves.

Prof. PERCY FRANKLAND (Birmingham), in reply to the question as to the depth at which sunlight acted, referred to the experiments of Buchner of Munich, who found that typhoid germs were still just affected at the depth of ten feet, but that below that depth they were not injured, though of course the sun's rays penetrated much further. Another investigation, by Procacci of Naples, on turbid water, showed that the depth to which the sun's rays exerted an influence was much more limited, no bactericidal action being discoverable at a depth of twenty-four inches. Taking into consideration the fact that nearly all surface waters in this country were more or less turbid, there must be a very effectual barrier to the penetration of the sun's rays into the deeper parts. He expressed satisfaction to find that Prof. Robinson's large experience accorded with his own; the instinctive prescience of English engineers must be admired, inasmuch as they had anticipated most of the results since confirmed by bacteriology. They had carried on a process of sand filtration in the face of criticism for many years, and it turned out that they were right. They also believed in the purification of water in flowing streams,

and although this must not be relied upon too exclusively, it certainly did take place to some extent. They were all in sympathy with Major Flower's efforts to preserve, in the purest state possible, that important branch of the London water supply derived from the River Lee. One of the useful results that had accrued from these hygienic enquiries into water supplies, was not only that the engineers exercised greater care in dealing with the water, but a large amount of pressure had been brought to bear upon towns which discharged sewage or other refuse liquids into rivers, with the result that the condition of the latter had greatly improved through the agency of these conservancy boards, which had been actively at work during the last twenty years. He alluded in terms of commendation to the extended and laborious investigations of the Massachusetts Board of Health which were of the very greatest utility. He said that theoretically a sand filter should be used as long as possible. It was the surface slime that really acted as the bacterial filter, but as the amount of water that passed through a given filter went on diminishing, it became necessary from time to time to remove the slime by scraping in order to keep the supply up to the requirements. There was one point in connection with this filtration which water engineers ought to bear in mind, viz., that the rate of filtration should be kept as constant as possible. Any interruption of that constancy led to imperfections in filtration. This was a matter of difficulty in some places because it necessitated considerable storage capacity for filtered water to maintain a constant supply throughout the twenty-four hours. It was a very general practice to run the water rapidly through the filters to supply the large demand in the morning, and then during the remainder of the day to keep down the rate of filtration. It would be a much better plan if filtration could go on at the same rate during the whole of the twenty-four hours. In respect of the vitality of the typhoid bacillus, their experience indicated that it did not multiply in ordinary potable water, even when that water was quite sterile. He was unable to say whether or not it multiplied in sewage. Experiments had been made with reference to the influence of adding organic matter to the water in which the bacilli were contained, but the organic matter added was in the form of meat-broth, not sewage, so that these experiments were not very much to the purpose. What they wanted to know was whether the admixture of sewage to water in such and such proportion permitted of the multiplication of the typhoid bacillus. He was not aware of any experiments having been made in respect of the diphtheria bacillus in water, but he pointed out that no outbreak of diphtheria had, he believed, ever been traced to contaminated water. Considering the very fragile nature of this bacillus he doubted whether it could live long, still less multiply, in water. So far as they were aware, the bacteria present in uncontaminated surface waters were quite harmless, indeed, not only were they not deleterious to health, but they even proved useful in arresting the vitality of pathogenic bacilli. Not only did they arrest the growth and multiplication of other organisms, but in the course of time they

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put an end to their own vitality. He pointed out that in deep-well water, which normally did not contain more than two or three bacteria to the cubic centimetre, there would be, on standing in any vessel, hundreds in the course of a few hours, and perhaps millions in two or three days, yet no one would object to drink deep-well water on that account. After a time the number of bacteria would diminish. If one took a surface water and kept it, it would be found that there was usually no very great multiplication, the multiplication having already taken place to its fullest extent during the previous history of the water. This was similar to what took place in any ordinary process of fermentation, in the alcoholic fermentation for example. He pointed out that the weight of these micro-organisms, even when numerous, was exceedingly small, far too small in fact to be detected by any chemical analysis. He explained that when the object was to ascertain the efficiency of filtration, the water should be collected for examination as soon after filtration as possible. As soon as the water had passed through the filter the few microbes remaining in it began to multiply, so that in a short time they might be as numerous as they were before. Any form of contamination might take place in cisterns, so that the water contained therein could not be utilised in considering the water-supply of towns. He was not personally acquainted with the sanitary condition of the City of Dublin, and could, therefore, offer no explanation of the curious prevalence of typhoid fever there, except that he understood that the soil on which it was built was permeated with the accumulated filth of centuries. He took it that though typhoid was frequently spread through water, yet that water carriage was not the only means by which it was disseminated. Then there was the very interesting point in reference to the effect of filtration of water rich in bacteria. The secreted products of non-pathogenic bacteria as they occur in ordinary potable water are presumably devoid of injurious qualities, and the ingestion of the small amount of toxins, which the few pathogenic bacteria might secrete, would *possibly* have the effect of more or less immunising the persons drinking that water against the particular diseases, although any precise evidence on this interesting point is entirely wanting. In any event, such toxins would not produce the disease, though they might give rise to some of its symptoms. Water which had been deprived of its bacteria might even, in a sense, be said to be itself immune to bacteria subsequently introduced, but if such water were boiled then bacteria might again multiply in it, this had been repeatedly shown.

Sir Douglas Galton, in moving a vote of thanks, said that anyone who wished to know more of this very interesting subject would do well to read the book on the subject written by Prof. Percy Frankland, who had studied the habits of all the bacteria likely to be found in water. He said that the sanitary engineer had derived great assistance from the inquiries which Prof. Percy Frankland had been carrying on for years, and he felt sure they were grateful to him for his very clear and lucid exposition of these interesting facts.

REVIEWS OF BOOKS.

"THE GEOGRAPHICAL DISTRIBUTION OF DISEASE IN GREAT BRITAIN."*

A very interesting book, with a misleading title; true there is, following page xvi., a half title which is fairly descriptive; but the words "Part I. The English Lake District" ought to have been on the Title page, because, at a rough estimate, the Lake District occupies nineteen parts of the book, and the rest of Great Britain only one part. The half title runs thus: "The Geographical Distribution of Diseases. Part I.—Cumberland, Westmoreland, and the Lake District; their Climatology, Geology, and Disease Distribution." We should have used the old fashioned designation of Physical Geography, or its modern equivalent, Physiography, because Mr. Haviland deals largely and well with the Orography, rivers, and watersheds of the district, and that is hardly either climatology, or geology, though of course related to both. The book presents the normal features of Mr. Haviland's style, a mass of information, not always fully digested, but set in language often of considerable beauty, and with quaint bits of classical and mediæval lore just where one does not expect them. We may as well justify this remark as to discursiveness by quoting a few subjects which while very interesting, do not *primâ facie* seem to be intimately connected with the subject of the book as set out on its second title page: "Sir Archibald Geikie on Britain joined to the Continent and its subsequent isolation—Vagabond parts of Counties and Districts—Sir A. Ramsay and submarine denudation—Men of the sharp stone period—The Isle of Man the Source of the Norwegians—Æacas—Oros—Mycelium of Carboniferous Age—The Delta of the Ganges." No one must imagine that the book is dry—quite the contrary. Mr. Haviland is rightly very indignant at what he describes as "the inextricable confusion in the Henniker-Ogle supplement for 1871-80," issued by the Registrar-General for England, and the exposure of it on pages 289-292, is amusingly severe, but we do not see the necessity for re-stating it under the somewhat quaint title, "Mixing the sexes in the Registrar-General's supplement," on pages 339-342. We agree with this criticism, but are not sure that Mr. Haviland has himself adopted the best mode of ascertaining and exhibiting the facts he has been studying; however he gives them, and others can study them and compare their conclusions with his, which are apparently summarized in the following sentences: "In the

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* The Geographical Distribution of Disease in Great Britain, by Alfred Haviland, M.R.C.S.E., Fellow of The Sanitary Institute, &c. 2nd Edition. Large 8vo. xvi.—406 pages, 8 coloured maps. Swan Sonnenschein & Co., *London*, 1892.

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meantime this investigation has not been without results; for its teaching has pointed out, however imperfectly, where it would be unsafe for the medical man to advise some of his patients to reside. With the *facts* before him, which twenty years' statistics spread over Great Britain have confirmed, no medical man would send:

"(1). A *consumptive* case to live where he would be subject to the *full force* of prevailing winds.

"(2). Or one dreading *rheumatism* and *heart disease*, into an unventilated pent-up valley, where the mortality from cardiac affections is high.

"(3). Nor would he send the offspring of *cancerous* parents to reside, either for education or earning their livelihood, into low-lying, clayey, flooded districts.

G. J. S.

"PRACTICAL SANITATION."*

In 1890, Dr. Reid delivered a course of lectures to Sanitary Inspectors at Stafford, under the auspices of the County Council, and the success of this course led to two further developments. The Sanitary Institute lent its aid in promoting further series of lectures, to like audiences, in Staffordshire and other counties, and Dr. Reid was induced to amplify his lecture notes into a handbook, with which neither Inspectors nor Medical Officers of Health can afford to dispense. It covers the field of "Practical Sanitation" in the sense of explaining clearly and fully, but still concisely, what a Sanitary Inspector ought to know, and it only goes outside that compass so far as is necessary in order to make clear the why and wherefore. Dr. Reid deals with Water, Warming and Ventilation, Sewage and Refuse Removal and Disposal, Drainage, Sanitary Appliances and Details of Plumbers' Work, House Construction, Infection and Disinfection, and Food; and in an Appendix contributed by Dr. Manley is given a comprehensive summary of Sanitary Law, including Acts of Parliament, Model Bye-Laws, and Local Government Board Orders. The work is a store of information, and includes many practical details, not to be found in the ordinary run of available text-books, which will be welcome to Medical Officers of Health as well as to Inspectors. It is liberally illustrated, well printed, and has the further recommendation of a full index. The third edition has been brought up to date in all essential points, and deserves the attention of practical sanitarians of every class.

A. W.

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* "Practical Sanitation." A handbook for Sanitary Inspectors and others interested in Sanitation, by George Reid, M.D., D.P.H., Fellow of The Sanitary Institute, and Medical Officer, Staffordshire County Council; with an Appendix on Sanitary Law, by Herbert Manley, M.A., M.B., D.P.H., Fellow of The Sanitary Institute, Medical Officer of Health, West Bromwich. Third Edition. 350 pp. Price, 6s. London, Charles Griffin & Co. 1895.

NOTES ON BOOKS AND PAPERS IN TRANSACTIONS.

The Institution of Civil Engineers. Vol. CXIX. 1894-5. Part I.

At the commencement of this Volume appears a Portrait of the President of the Institution, Sir Robert Rawlinson, K.C.B., along with his Presidential Address, which is largely devoted to "Sanitary Engineering."

The following papers of Sanitary interest appear among the "Abstracts of Papers in Foreign Transactions and Periodicals":—

"The Ventilation of Mines and Centrifugal Ventilators," by PAUL HABETS. (Revue Universelle des Mines et de la Métallurgie, July, 1894.)

"The Flue-Dust Condensers of the Freiberg Smelting Works," by C. H. BAUER. (Jahrbuch für das Berg und Hüttenwesen im Konigreich Sachsen, 1894.)

"A Compressed Air Installation in the Freiberg Mine," by R. WENGLER. (Jahrbuch für das Berg und Hüttenwesen im Konigreich Sachsen, 1894.)

Vol. CXX. 1894-5. Part II.

The following papers appear among the "Abstracts of Papers in Foreign Transactions and Periodicals":—

"The Flow of Rain-water in Drainage Sewers," by A. FRUHLING, (Der Civilingenieur, 1894.)

"On the Disinfection of Fœcal Matters by Peat, and the General Treatment of Excreta," by Prof. A. GARTNER. (Zeitschrift für Hygiene, 1894.)

"On the Evaporation of Quicksilver in Dwellings," by Prof. K. A. H. MORNER, of Stockholm. (Zeitschrift für Hygiene, 1894.)

"Heating of Rooms by Gas Stoves and by Anthracite Stoves," by AIME GIRARD. (Bulletin de la Société d'Encouragement pour l'Industrée Nationale, 1894.)

Vol. XXI. 1894-5. Part. III.

In this Volume, among "Other selected papers," Mr. W. FAIRLEY contributes a paper on "The Main Drainage and Sewage Disposal of Edinburgh," and Mr. J. S. SINCLAIR on "Widnes Sewerage."

Among Abstracts of Papers in Foreign Transactions and Periodicals are the following:

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"The Drainage of Paris," by BECHMANN and LAUNAY (Annales des Ponts et Chaussées, March, 1895).

"The Pollution and Cleansing of Rivers in accordance with Experiments on the water of the Oker," by Dr. R. BLASIUS and Dr. H. BECKERTS (Deutsche Vierteljahrsschrift für Öffentliche Gesundheitspflege, 1895).

"Further investigations respecting the Disinfecting Power of Soap Solutions, by Dr. MAX JOLLES (Zeitschrift für Hygiene, 1895).

"The Hygienic Utility of Light," by Dr. W. KRUSE (Zeitschrift für Hygiene, 1895).

Proceedings of the Incorporated Association of Municipal and County Engineers. Vol. XX. 1893-4. 383 pp., 8vo.

The Association during the course of the year held meetings at Leicester, Reading, Keighley, Chester, Torquay, of which a full account is given in this Volume. The Sewage Systems, Water Works, and other works connected with Municipal Sanitation in these towns were dealt with, and among other papers read were:

"Carriageway Pavements," by C. MASON.

"Hospital Tents at Wimbledon," by C. H. COOPER.

"The Development of Sanitation in America," by Lieut.-Colonel A. S. JONES.

"Teddington Sewage Disposal Works," by H. YORK.

Transactions of the Society of Engineers for 1894, and General Index 1857–1894. 289 pp., 8vo. London.

The only paper in this Volume that calls for mention from a Sanitary point of view, is

"The Utilisation of Town Refuse for Generating Steam," by T. W. BAKER, B.A.

Transactions of The Surveyors' Institution. Vol. XXVII. 1894-5.

Contains among other papers, On the London Building Act, 1894, by H. Blackbourn, Village Water Supplies, by R. E. Middleton, with the Discussions upon them.

Journal of the American Public Health Association. Vol. XX. Quarterly Series, Vol. I., Part I. 1895. 8vo.

The Association formerly issued its proceedings in a yearly volume, but decided from January this year to issue them in future in the form of a Quarterly Journal, for the obvious reason that members would receive the reports and papers of the Association

each quarter, instead of nearly a year after the papers were read, as is too often the case with yearly volumes.

The first part consisting of 122 octavo pages, contains a record of the proceedings at the Annual Meeting at Montreal, along with the Address of the President of the Meeting, E. Persiller-Lachapelle, M.D., and Addresses by the Chairman of the Local Committee, the Lieut.-Governor of the Province of Quebec, and the Mayor of Montreal.

Dr. H. F. Nuttall read a paper entitled "Hygienic Notes made on a short journey through Italy in 1894." The following papers will also be found with the Discussions upon them :—

"The Cart before the Horse."

The object of this paper may be briefly embodied in the two following propositions extracted from the paper:

First. Copious Water Supplies with the aid of what is known as modern plumbing, constitute a means of distributing fœcal pollution over immense areas, through the soil, through subterranean water courses, and in surface streams, and cannot therefore be regarded with unmixed approbation by the sanitarian.

Second. The question of Drainage and Sewerage whether for individual residences or communities, should always precede that of water supply, and no water closet should ever be allowed to be constructed until provision has been made for the disposition of its effluent in such a manner that it should not constitute a nuisance prejudicial to the public health.

"Observations of the Sedimentation of Water," by WYATT JOHNSON, M.D.

"The Well Waters of our Farm Homesteads," by FRANK T. SHUTT, M.A., F.I.C., F.C.S.

"Pure Water and Purified Water for Public Water Supplies," by DANIEL W. MEAD.

"Water Supply for Towns," by A. P. REID, M.D.

"Some Deductions from Bacteriological Work on the Water of Lake Ontario," by E. B. SHUTTLEWORTH, Ph.D., F.C.S.

"Sand Filtration of Water, with special reference to results obtained at Lawrence, Massachusetts," by GEORGE W. FULLER, B.Sc.

"Report of the Committee on the Pollution of Water Supplies," by CHARLES SMART, M.D.

"Management of Diphtheria Epidemics in Rural Districts," by CHARLES A. HODGETTS, M.D., L.R.C.P.

"Practical Difficulties of Medical Officers of Health and Physicians in dealing with suspected cases of Diphtheria," by P. H. BRYCE, M.A., M.D.

"Des Inoculations Preventives dans les Maladies contagieuses," by Dr. J. E. LABERGE.

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Part II. 1895.

Among the nineteen papers in the number, all of which are important from their Sanitary aspects, are the following:—

"Innocuous Transportation of the Dead;" "Prevention of Tuberculosis;" "Vaccination;" "Prevention of Yellow Fever;" and the "Reports of two Committees of the Association on Car Sanitation, and the Disposal of Garbage and Refuse."

Part III. 1895.

Nearly half of this number is devoted to "School Hygiene," including a discussion on the subject under the following headings:—

"Instruction in Hygiene in Schools and Colleges," by C. O. Probst, M.D.

"Hygiene of Vision in Schools," by T. D. Reid, M.D.

"Teaching of Hygiene in Elementary Schools," by Saraphin Gauthier, M.D.

"On Teaching the Principles of Hygiene to the Young," by George G. Groft, M.D.

"Some Points in the Hygiene of the Young in Schools," by J. Chalmers Cameron, M.D.

"Ventilation of School Houses," by J. E. Dore.

Among other papers are:

"The Drainage and the Present Sanitary Condition of Montreal," by L. Zaberge, M.D., and Alfred Brittain.

"Plumbing in Sanitation," by John Mitchell.

And a Discussion on "Influence of Inebriety on Public Health;" also a Report of Committee on "Water Supplies."

"The Student's Handbook of Forensic Medicine and Public Health," by H. Aubrey Husband, M.B., B.Sc., late Lecturer on Medical Jurisprudence and Public Health in the Extra-Academical School, Edinburgh. 6th Edition. 692 pp., 8vo. Edinburgh, 1895. *Price 10/6.*

Nearly two-thirds of this book is devoted to Forensic Medicine and Toxicology, leaving the remaining third to form the "Student's Handbook" on the subject of Public Health. Among the questions dealt with are Vital Statistics, Life Assurance, Air, Ventilation, Meteorology, Drainage. Infectious Diseases, Duties of Medical Officers of Health and Sanitary Inspectors, &c.

"Hygiene and Public Health," by LOUIS C. PARKES, M.D., D.P.H. Lond. Univ., Lecturer on Public Health, St. George's Hospital Medical School, and Medical Officer of Health and Public Analyst, Chelsea. 4th Edition. 531 pp., 8vo. *H. K. Lewis. Price 10/6*

The author's aim in writing this book has been to provide a suitable work for those preparing for Public Health Diplomas, including nearly the whole field of sanitary science within as small a space as possible, thus affording the reader such elementary knowledge as would enable him to refer with advantage to the larger text books.

Questions of Water, Disposal of Refuse, Air, Ventilation, Warming and Lighting, Climate, Food, Soil, Clothing, Communicable Diseases and Statistics, are dealt with in the ten Chapters.

There are numerous Illustrations.

"The Elements of Health," by LOUIS C. PARKES, M.D., D.P.H.Lond. 246 pp., 8vo. *J. & A. Churchill. Price 3/6*

The intention of this little work is to form an introduction to the study of Hygiene. The author's main idea has been to give some simple yet practical information and instruction on the preservation of individual or general health in the ordinary routine of domestic life. Matters relating to Public Health have for the most part been avoided.

"Manual of Hygiene for Schools and Colleges," prepared by the PROVINCIAL BOARD OF HEALTH OF ONTARIO. 293 pp., 8vo. *W. Briggs, Toronto. Price 50 Cents.*

This is a manual intended especially for teachers and pupils attending the normal and other schools of the higher grade, forming a sort of go-between from the children's Elementary Text Books to the advanced Treatises of Medical Men and Sanitary Experts.

The book is issued and authorised by the Minister of Education for use in all schools under the control of the Education Department, and the various Chapters have been written by members of the Provincial Board of Health of Ontario.

"The Food Inspector's Handbook," by FRANCIS VACHER, F.R.C.S., Medical Officer of Health for Cheshire County Council. 154 pp., 8vo. *The Sanitary Record Office. Price 2/6.*

This is the second Edition of this Book called for within eighteen months after the publication of the first. The work has been revised, and the number of Illustrations has been doubled.

As an Introduction, the author discusses the powers and qualifications of a Food Inspector, the succeeding Chapters dealing with the Diseases of Animals which render Meat, Fish, Poultry, Fruit, Vegetables, Milk, &c., unfit for Human Food.

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SIXTY-THIRD ANNUAL MEETING OF THE BRITISH MEDICAL ASSOCIATION.

The Annual Meeting of the British Medical Association was held in London, on July 30th and 31st, and August 1st and 2nd. The President, Sir J. Russell Reynolds, F.R.S., gave an inaugural address on, "The Power of Life in Life." He reviewed the work of the Association and the progress of medical knowledge since the previous meeting of the Association in London, in 1873, referring in the course of his address to the late Dr. E. A. Parkes, whose labours in the cause of Hygiene are so much revered.

THE PUBLIC HEALTH SECTION.

Presided over by Ernest Hart, D.C.L.

The subject of the Presidential address was, "Public Health Legislation and the Needs of India." He commenced by referring to London as the healthiest city in the world, with a mortality of only 18 per 1,000.

He then discussed some of the recent legislation affecting sanitary administration, and lamented that the recommendations of the Royal Sanitary Commission had not been adopted with regard to making large sanitary areas, whose boundaries should be established with due relation to the watersheds, nor with regard to the appointment of Medical Officers with a fixity of tenure.

On the question of the relation of health to water supplies, he pronounced a very strong opinion that Cholera "is wholly, essentially, and universally a water-borne disease." He also pointed out that typhoid was due to neglect of the water supply, and that in English towns where the water supply had been improved, there had followed a great reduction in the typhoid fever death-rate.

In dealing with Indian sanitary needs, Mr. Hart again referred to the water-borne origin of Cholera, and described as "a disgraceful public document" the army medical regulations now in force, which were based on the theory that Cholera was caused by telluric influences, pandemic waves, cholera mists, blue clouds, the influence of trees, and such like bogies. Water being such an important factor in the spread of disease, the filters supplied to the troops should be selected with great care, whereas under the present system they were "the worst in the world."

The Army Medical Officers are overloaded with routine work, and sanitary study and scientific work are discouraged. What is urgently needed is a Royal Commission or strong Departmental Committee, to enquire into the whole matter, and to institute a radical change.

The first subject discussed was The Regulation of the Slaughter of Animals for Human Food. The discussion was opened by Dr. T. M. Legge, of London. After referring to the regulations in force in France, Belgium and Denmark, he proceeded to describe the routine method of meat inspection abroad, which is almost entirely in the hands of veterinary surgeons and highly trained experts. He thought that the English law was very defective, as it gave no indication as to what diseases in animals made meat unfit for human consumption. With regard to the danger of eating tuberculous meat, he hoped that the recent report of the Royal

Commission on Tuberculosis, would awaken public opinion, which was at present very lukewarm on the subject.

Dr. Sydney Marsden, of Birkenhead, who followed, said that the consideration of the subject naturally divided itself into three heads:

1. Treatment of cattle before slaughter, lairage accommodation, &c.
2. Method of slaughter and dressing of animals.
3. Treatment and inspection of the carcass after dressing.

He thought it important that the carcass should be inspected both before and also after cooling, as there are some diseases which show most distinctly before anything has been done to alter the appearance of the carcass, while others are more easily recognised after cooling, as regards colour or smell, or both.

Dr. Sykes, of St. Pancras, advocated the purchase, at the public expense, of diseased meat before exposure for sale, or failing this, the compulsory examination and marking of all meat for sale.

Surgeon-Major George Poole and Dr. Alfred Hill, of Birmingham, were severe in their condemnation of private slaughter-houses.

Dr. Legge in his reply said that there appeared to be no power in London, or elsewhere, to close any private slaugther-houses, except in places where a license was required, and then the end could be accomplished by not granting a renewal.

THE PREVENTION OF MILK EPIDEMICS was introduced by Dr. H. Kenwood.

He said that the careful examination of all milch cows at short intervals, preferably once a week, the prompt isolation of those animals likely to furnish infective milk, and the adoption of means that would deter the cowkeeper from mixing the milk of such animals with other milk, were, in his opinion, the only ways of dealing with the difficulty. He then dwelt on the necessity for the appointment of special inspectors of cows and cowsheds, discussed the qualifications of such inspectors, and recommended their appointment in some cases by neighbouring authorities in combination. The necessity for such inspectors to notify at once all cases of suspicious disease in cows to the medical officer of health was pointed out.

Dr. Bond thought that the expense, which would be necessary to carry out, with anything like efficiency, the system of inspection which Dr. Kenwood advocated, would make the sanitary authority of his district raise their eyes in horror at the suggestion. At the same time he warmly endorsed the suggestion.

THE VACCINATION LAWS, by Dr. T. Garrett Horder.

Dr. Horder pointed out that the amount of protection afforded by vaccination depended entirely on the efficiency with which the operation had been performed. Dr. Gayton's statistics showed that in the Metropolitan Asylums Board Hospitals the patients with good vaccination marks had a mortality of 3 per cent., those with imperfect marks a mortality of 9 per cent. He proposed that vaccination should be taken out of the hands of private practitioners and placed in the hands of medical men appointed by the Local Government Board.

A NATIONAL SYSTEM OF NOTIFICATION OF SICKNESS was advocated by Dr. *A. Newsholme*, of Brighton. He pointed out that from a public health point

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of view it was very desirable that the Medical Officer of Health should have knowledge of the occurrence of tuberculosis, rheumatic fever, and other diseases not generally classed as infectious. He summed up his paper with suggestions to the following effect: (1) Extend the schedule of notifiable diseases. (2) Make it compulsory on all friendly and similar societies, hospitals, and dispensaries to furnish periodical returns of the number and duration of cases of sickness and their nature. (3) Establish a central office for the collation and tabulation of these data.

The Desirability of Appointing Medical Men as Superintendent Registrars of Births and Deaths, by Dr. Louis C. Parkes.

Although it is no part of the Registrar's duty to question the truthfulness of any of the statements in a death certificate given by a registered medical practitioner, a large amount of responsibility rests upon him in reporting to the coroner deaths attended "by suspicious circumstances," and the trained perception of a medical man might detect unusual or suspicious circumstances where a layman would be quite at fault. Medical knowledge on the part of the Registrar would also be of advantage from the point of view of statistical correctness. Dr. Parkes thought that the combination of the posts of Medical Officer of Health and Superintendent Registrar of births and deaths would increase their sphere of usefulness in a direction which would be of great advantage to the public interests.

The Insecurity of Tenure of Extra Metropolitan Medical Officers of Health, discussion introduced by Dr. B. A. Whitelegge and Dr. J. Carroll.

This is a subject of considerable importance with regard to the efficiency of sanitary administration, and one that was sure to be brought forward at a meeting of medical men interested in public health. Medical Officers of Health from all parts of the country took part in the discussion. The general outline of the case and the arguments with regard to it are pretty well known, and there seems no valid reason for the anomalous position in which these officers are placed, more especially as the London Public Health Act of 1891 provides that the appointment of Medical Officers of Health in London shall not be for a limited time, and that they shall not be removable without the consent of the Local Government Board.

The Late Visitation of Cholera in Hungary.

By Eugene Farkas, M.D., District Superintendent of Public Health, Budapest.

Referring to the epidemic of the summer of 1892, he said that the Government made strenuous efforts to prevent the importation of cholera by imposing medical inspection on travellers and their baggage, and restriction upon the importation of goods from infected countries; but experience showed that these restrictions, which nearly annihilated commerce, were useless, and in November most of the restrictions were abandoned and sanitary measures adopted. The subsequent visitations of cholera in 1893 and 1894 were unable to obtain a hold in the country.

Dr. Farkas concluded by saying "We cannot hope for any success except by means of general sanitation, as was pointed out by Sir John Simon thirty years ago."

TYPHOID FEVER AS A DIRECTLY INFECTIOUS DISEASE, by Dr. J. Priestley, M.O.H., Leicester.

During the year 1892-4 there were notified in Leicester 634 cases of typhoid fever; all these were visited and careful notes made of their origins. It was found that houses where pail-closets were used were infected nearly three times as often as those where water-closets were adopted; he then gave notes of a number of the cases observed.

The subject of DIPHTHERIA AND ITS DIAGNOSIS IN DOUBTFUL CASES BY THE USE OF BACTERIOLOGY, was introduced by Dr. E. Klein. His paper contained records of interesting experiments and examinations into the subject, but naturally dealt more with medical and bacteriological than the sanitary aspect of the question.

It was followed by a paper on THE USE OF DIPHTHERIA ANTI-TOXIN FOR IMMUNISATION, by Dr. Hermann M. Biggs, Director of the Bacteriological Laboratories of the New York City Health Department. He said that by the use of anti-toxin it had been found possible to completely stamp out diphtheria in four great institutions for children in which it was prevailing in epidemic form. In no instance had there been, so far as can be determined, any serious results from the administration of the remedy for this purpose. The duration of immunity is apparently not more than thirty days in many cases.

VITAL STATISTICS OF DIPHTHERIA IN LONDON, 1891-95, given in a paper by F. A. Dixey. It was well illustrated by Tables showing the death-rate from diphtheria and croup. He supported the theory that the increased prevalence of diphtheria in this country is at least partly due to the operation of the Elementary Education Act. In discussing the question of the relation between diphtheria and croup, he quoted the opinion of Dr. Longstaff and Dr. Whitelegge that there is no such disease as croup, and that a great deal of so-called croup is actually diphtheria. A Table of the diphtheria cases in London Hospitals, and the fact that from some quarter fatal diphtheria had received a check, showed, he thought, that the anti-toxin treatment was instrumental in preventing the autumnal rise in the number of fatal cases in 1894, and had helped in 1895 in keeping down the diphtheria mortality, in spite of the large amount of disease still present in the metropolis.

Many of the points raised in these papers dealing with diphtheria were brought forward by Dr. Thorne Thorne in the Journal of the Institute, Vol. XV., page 7.

HOSPITAL ISOLATION AND THE DISINFECTION OF PATIENTS, discussion introduced by Dr. P. Boobbyer, M.O.H., Nottingham.

He considered that the existing system under which each sanitary authority is left very much to do as it pleases in the way of providing, or practically neglecting to provide, adequate hospital accommodation for the infectious sick in its district is in the highest degree unsatisfactory. He deprecated the erection of large permanent hospitals, designed to meet the requirements of very wide surrounding areas, and thought there was much to be said in favour of small, permanent, local hospitals. He wished to be understood, however, that he did not advocate the erection of separate hospitals for every village or group of villages in a sparsely inhabited district. Small-pox had to be separately dealt with, but he thought that these cases could more easily be taken to a distance than scarlet fever cases.

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In reviewing the question of Disinfection, he had come to the conclusion that in scarlet fever too much importance had hitherto been attached to the dry cuticle as an infecting agent, and too little to inflammatory products from the naso-pharynx and elsewhere.

In the discussion, Dr. J. Spottiswoode Cameron, M.O.H. Leeds, desired to lay stress on the necessity of making the isolation of the patient complete by removing all infected articles.

Dr. E. W. Goodall, of Fever Hospital, Homerton, said that the non-disinfection of clothing accounted for a good many instances of second cases.

Dr. Sidney Barwise, County Med. Officer, Derbyshire; Dr. G. H. Fosbroke, County M.O.H. Worcestershire; and Dr. F. T. Bond, M.O.H., Gloucester Combined District, strongly urged the inexpediency of constructing small hospitals scattered over the district, and thought that patients could be conveyed ten or eleven miles to a central hospital without injury.

Papers were read on UNDERGROUND WORKSHOPS, by Dr. F. J. Waldo, M.A., and Dr. David Walsh; and on DRY METHODS OF DEALING WITH URINE, by Dr. G. V. Poore. As papers on similar subjects by the same authors have recently been published in the Journal of the Institute, Vol. XV., page 21, and Vol. XVI., page 227, it is unnecessary to refer to them fully.

DISCUSSION ON SEWER VENTILATION. Introduced by T. Parry Laws, F.I.C.

The injurious effects attributed to sewer air may arise from three separate and distinct causes:

1. From poisonous inorganic gases.
2. From organised constituents (micro-organisms) of sewer air.
3. From the presence of some volatile and highly poisonous organic compound.

The second cause, which has found most general acceptance, is founded on two assumptions: That sewage matter swarms with the specific germs of disease; and that these germs, living and multiplying in the sewage, can rise into the sewer air and be carried far and wide, wherever the smell of sewage can penetrate.

Numerous experiments of Carnelli, Haldane, Petrie, and others, had proved, however, that the number of micro-organisms in the sewer air, bore a close resemblance to those in the fresh air finding access to the sewers, and where the ventilation was imperfect, the number was less.

The experiments have shown that the micro-organisms of sewer air bear no relation whatever to those of sewage, and that the predominant micro-organisms of sewage are entirely absent from sewer air. If sewer air is free from those special organisms which exist in immense numbers in every drop of sewage, how infinitely improbable becomes the existence of pathogenic organisms which can only be present in sewage, relatively speaking, in most minute proportion.

James T. Neech, Medical Officer of Health, Atherton, discussed the question whether sewers should be ventilated at all. He thought that a perfect sewer, with the house drains properly disconnected, need not be ventilated; but inasmuch as no sewers with their connection fulfilled these conditions, they should be ventilated. He then reviewed the various methods of ventilation and the conditions which affected them.

Dr. Oldright, Ontario, referring to the healthiness of sewer men being quoted as evidence of the harmless effect of sewer air, said that a similar observation would apply to many other filth works. It was due largely to the fact that as a rule none but robust men undertook such positions, and most of their work was out of doors.

Dr. Bond, Medical Officer of Health, Gloucestershire, said that the Bristol sewers were not ventilated at all, and yet the town was singularly free from typhoid fever.

A discussion on THE DESTRUCTION OF TOWN REFUSE BY HEAT was opened by Dr. J. Spottiswoode Cameron. He gave details of experiments made in Leeds since 1876, with the relative advantages of introducing steam jets of various sizes into the destructor cells. He gave the cost of destruction as working out at 2s. a ton, including plant and all other expenses.

Brigade-Surgeon Pringle referred to the Tobhet of Jerusalem and the burning fiery furnace on the plains near Babylon as vast receptacles for burning the city refuse.

In a discussion on SMOKE ABATEMENT, Brigade-Surgeon Lieut.-Col. Pringle gave a description of the composition of fog, and Dr. W. Graham gave a short history of Smoke Abatement Institutions which originated in the meeting of the British Association in Manchester in 1842.

This brief epitome of the papers and discussions at the meeting of the Section of Public Medicine is only intended to indicate the points raised. The papers are not referred to in the order read, but have been grouped so that similar subjects come together. A full account is given in the *British Medical Journal*, Aug. 3rd and 31st, 1895.

E. W. W.

NOTES ON LEGISLATION AND LAW CASES.

Prepared by Prof. A. Wynter Blyth, Barrister-at-Law.

Before JUSTICE WILLS.

(*Times*, April 29th, 1895.)

CLAYTON *v.* SMITH.

Recovery by Local Authority of expenses of house drainage. Question of liability construction of a wide clause in a lease.

This was an action brought by the plaintiff, who was tenant of a house at Chelsea under a lease for fifteen years, dated 1880, for a declaration that he was entitled to deduct from his rent a sum of £42 which he had paid to the Local Authority under the following circumstances:—The Local Authority had served a notice on him to connect the drains of the house with a sewer. The notice was sent on to the landlord, who did nothing. The Local Authority accordingly, acting under the Metropolis Management Acts, 18 and 19 Vic., c. 120, section 93, and 25 and 26 Vic., cap. 102, section 96, did the work themselves and made the tenant pay. This the tenant

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desired to deduct, but the landlord refused, relying on the following clause in the lease, on which the whole question turned:—The tenant "also shall and will bear and pay and discharge the land tax, sewers rate, main drainage rate, rates under the Metropolitan Board of Works, and tithes, or tithe commutation rent-charge in lieu thereof, and all other taxes, rates, charges, duties, assessments, and payments whatsoever, whether Parliamentary, parochial, or otherwise, which are or which at any time during the continuance of the said term shall be taxed, rated, charged, assessed, imposed upon or payable in respect of the said premises hereby demised, or any part thereof, or upon the landlord or tenant in respect thereof (except the landlord's property tax)."

Mr. Salter appeared for the plaintiff.

Mr. Hume-Williams, for the defendant, cited "Budd *v.* Marshall" (5 C. P. D., 481), "Tidswell *v.* Withworth" (L. R., 2 C. P., 326), "Thompson *v.* Lapworth" (L. R., 3 C. P., 149).

Mr. Salter urged, in reply, that this was not an assessment or rate, and tried to distinguish the case of "Budd *v.* Marshall" from the present. He said the nature of the work in that case was different. The work was done under a different statute.

Mr. Justice Wills, however, held that the cases were not to be distinguished, and gave judgment for the defendant.

QUEEN'S BENCH DIVISION.

Before Mr. Justice Wright, and Mr. Justice Kennedy.

(*Times*, July 5th, 1895.)

THE QUEEN *v.* THE VESTRY OF ST. GEORGE, HANOVER-SQUARE.

Section 138, Metropolis Management Act, does not empower the London County Council to take the initiative to order a Metropolitan Local Authority to make a new sewer.

This was a rule calling upon the Vestry of St. George, Hanover-square, to show cause why a writ of *mandamus* should not issue directed to them commanding them to comply with an order made by the London County Council, dated December 4, 1894, directing the vestry to construct a sewer therein described, or to execute sufficient works to secure the communication with the main sewers of the metropolis, of the sewer or drain receiving sewage from the premises in the said order mentioned. The question was whether the London County Council has the power of taking the initiative by ordering a vestry to construct specific sewers which the Council in its discretion thinks ought to be constructed.

Mr. E. Harrison appeared in support of the rule; Mr. Channell, Q.C., and Mr. Macmorran showed cause.

Mr. Justice Wright, in giving judgment, said,—The question is whether the County Council, as representing the old Metropolitan Board of Works, has the power of compelling the vestry to construct this sewer. By section 135 of the Metropolis Management Act, 1855, the Metropolitan Board of Works was intrusted with the

powers over sewers; not an absolute duty, but with powers. The question is whether section 138 authorizes the County Council, which now represents the old Metropolitan Board of Works, to make the order in question. Stated shortly, it appears to me that the section does not empower the County Council to take the initiative by ordering specific new works of sewerage. I think that if a new sewer is made, it must be made in such a way as the County Council approves, but I see nothing which authorizes the County Council to take away from the vestry the initiative as to making new sewers and to replace the discretion of the vestry by its own discretion. I think this view is supported by the case of "The Queen *v.* the Vestry of St. Luke's, Chelsea" (31 *L.J.*, Q.B., 50), which seems to me to throw some light upon the matter.

MR. JUSTICE KENNEDY concurred.

Rule discharged.

Before Mr. BARON POLLOCK and Mr. JUSTICE WRIGHT.

(*Times, July* 30*th*, 1895).

THE BRITISH INSULATED WIRE CO. *v.* PRESCOTT URBAN DISTRICT COUNCIL.

Contracts made by Urban Authorities under the Public Health Act are invalid unless some pecuniary penalty in case of failure be provided under Sect. 174 (2) *P. H. Act,* 1875.

This was a case of great importance to persons contracting with Urban Authorities. By Section 174 (2) of the Public Health Act, 1875, dealing with contracts under the Act by an Urban Authority, it is provided as follows:—" Every such contract . . . . shall specify some pecuniary penalty to be paid in case the terms of the contract are not duly performed." The question was whether a contract without such pecuniary penalty being provided for was valid. The Court held that it was not. This was a special case stated in an action brought on an agreement for money due for the supply of electric light.

Mr. Arkle (Mr. Lawson Walton, Q.C., with him), appeared for the plaintiffs; Mr. Danckwerts for the council.

The contract was originally made between the Company and the Local Board, the predecessors of the Urban District Council. The plaintiffs carried out the agreement by supplying the electric light from January 1st, 1893, to March 31st, 1895, and had been paid up to June 30th, 1894. The action was for £278 for quarterly payments and extra lamps. The agreement, dated November 12th, 1892, was one for the supply of light for five years. There was no pecuniary penalty, but there was a provision for arbitration in case of any dispute. These cases were referred to:—" Young *v.* Mayor of Leamington" (8 A.C., 517); "Mellis *v.* Shirley Local Board" (16 Q.B.D., 476); " Noel *v.* Worcester" (9 Ex., 457).

The COURT were of opinion that the agreement was not binding and gave judgment for the defendants.

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GENERAL NOTES.

Query. Please let me know the maximum amount of rain that fell in a certain period of time on Saturday evening, 10th August. The information is required to determine if the capacity of certain drains is sufficient to properly take away abnormal rainfalls. T. F. M.

Answer. No record of rainfall is kept at the Institute, but I find that at Mr. Symons' British Rainfall Station the rain on the evening of the 10th August nearly all fell in eighteen minutes. The total was 0·67 inch, and during the eighteen minutes above referred to, it fell steadily at the rate of two inches an hour. In Symons' British Rainfall, published annually, there is a diagram showing the rate of heavy falls in short periods, the normal and abnormal rates being indicated; falls of over half an inch in one hour, or one inch in two hours are not unusual. E. W. W.

Report on Food Adulteration.—The report of the Select Committee to inquire into the question of food products adulteration has issued its report. The committee state that they have taken further evidence, but have not had sufficient time to conclude their investigation. They therefore recommend that a committee on the same subject should be appointed in the next Parliament.

The Sanitary Association of Scotland held its 21st Congress at Greenock, commencing August 28th, under the Presidentship of Sir Michael R. Shaw Stewart, Bart. The following papers were read and discussed: "Mortality Rate in Scotland relating to Sanitary Progress," by Prof. Hay; "An Historical Sketch of the Sanitary Condition of Greenock," by the M.O.H., Greenock; "Smoke Abatement," by G. C. Thompson; "Ventilation of Sewers and Drains," and "Public Baths and Wash-houses," by Baillie Dick; "Infectious Diseases in Scotland," by Dr. A. C. Munro; "Diphtheria and its Prevention," by Dr. Leslie Mackenzie; "Diseases of Occupations," by Dr. T. G. Nasmyth; and "Housing of the Submerged Tenth," by Baillie Chisholme. The next Congress of the Association will be held at Dumfries.

Scientific Instruction in Hygiene for Women.—The Council of Bedford College, London, have determined upon the institution of a complete and scientific course of instruction in hygiene, to commence in October, and extend over one session, divided into three terms. This course has been arranged with a view to provide systematic instruction in hygiene, and also to give ample opportunity to women students for practical work in those branches of science which are essential to a thorough knowledge of sanitation, laws of health, and personal hygiene. The course will include lectures on hygiene by Dr. Louis Parkes, scientific instruction and practical work in chemistry under Holland Crompton, F.C.S., and physics and meteorology under F. Womack, B.Sc., M.B., physiology and bacteriology under A. A. Kanthack, M.D. The students will have practical work in the laboratories of the College, and demonstrations will be given in the Parkes Museum and elsewhere. There are altogether some eight lectures each week throughout the session, as well as the practical work and demonstrations. The course therefore seems to afford an opening to women for the scientific study of hygiene in its several branches, and will no doubt be welcome now that the field of sanitary and hygienic appointments is gradually opening to them.

Sanitary Congress, Paris.—In connection with the "Exposition Internationale d'Hygiene" recently held in Paris, the Société des Ingénieurs et Architectes Sanitaires held a Congress for the discussion of questions affecting municipal sanitation, house sanitation, and general health questions. Among the subjects dealt with were: The disposal of slop-water in villages. Public baths, The rational warming of houses, Uniform methods of tabulating sanitary statistics. The Transactions of the Congress will be published in October or November. E. W. W.

MEETINGS HELD JUNE TO OCTOBER, 1895.

Examinations.

Examinations for Inspectors of Nuisances.—These were held in the following towns:

Huddersfield, July 12th and 13th. 46 candidates presented themselves, and 28 were certified to be competent as regards their sanitary knowledge to discharge the duties of Inspectors of Nuisances. Dr. J. R. Kaye, the Medical Officer of Health, attended as a visitor, he also arranged visits to the Abattoirs, Sewage Works, &c. A number of the candidates availed themselves of these visits.

Norwich, July 19th and 20th. 24 candidates presented themselves, and 14 were certified to be competent as regards their sanitary knowledge to discharge the duties of Inspectors of Nuisances. The Mayor of Norwich and the Chairman of the Sanitary Committee attended the Examination as visitors.

Receptions during the Meeting of The British Medical Association in London.

The Council of the Institute arranged the following subjects for discussion at the above Receptions:—

The Position of Medical Officers of Health in regard to the Administration and Working of the Infectious Diseases Notification Act. By Sir Thomas Crawford, K.C.B., L.L.D., Q.H.S., M.D. (See page 353.)

The Teaching of Hygiene as illustrated by The Parkes Museum. By Prof. A. Wynter Blyth, Barrister-at-Law, M.R.C.S., F.I.C., F.C.S. (See page 362.)

The Pollution of Streams. By George Reid, M.D., D.P.H. (See page 369.)

The Bacterial Purification of Water. By Professor Percy Frankland, F.R.S. (See page 383.)

Twentieth Course of Lectures and Demonstrations to Sanitary Officers.

This course commenced on September 3rd. There was an attendance of over 70 at the first Lecture, and the number of Students has now increased to 114. A list of these Lectures and Demonstrations will be found in the Calendar, and also in the Advertisements.

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FORTHCOMING MEETINGS.

CALENDAR, OCTOBER TO DECEMBER, 1895.

Council Meetings are held Monthly on the Second Wednesday in each Month.

Finance Committee	Second Wednesday.
Exhibition Committee	First Tuesday.
Congress and Editing Committee . . .	Second Monday.
Education Committee	Third Monday.
Museum and Library Committee . . .	Fourth Monday.

OCTOBER.

1 T. Lecture to Sanitary Officers, London, 8 p.m. Sanitary Law: English, Scotch and Irish; General Enactments Public Health Act, 1875, Model By-Laws, &c., by Herbert Manley, M.A., M.B., D.P.H.

4 F. Lecture to Sanitary Officers, London, 8 p.m. The Law relating to the Supervision of Food Supply, by A. Wynter Blyth, M.R.C.S.

5 S. Inspection and Demonstration at the Wimbledon Sewage Works, at 3 p.m.

8 T. Lecture to Sanitary Officers, London, 8 p.m. Sanitary Laws and Regulations governing the Metropolis, by A. Wynter Blyth, M.R.C.S.

9 W. Inspection and Demonstration at Casual Wards and Disinfecting Station, Chelsea.

11 F. Lecture to Sanitary Officers, London, 8 p.m. Objects & Methods of Inspection, by J. F. J. Sykes, D.SC., M.D.

12 S. Inspection and Demonstration at Southwark and Vauxhall Waterworks, Hampton, 3 p.m.

15 T. Lecture to Sanitary Officers, London, 8 p.m. Nature of Nuisances, including Nuisances the abatement of which is difficult, by Arthur Newsholme, M.D., D.P.H.

16 W. Inspection and Demonstration at the Disinfection Station, &c., at St. Pancras, at 3 p.m.

18 F. Lecture to Sanitary Officers, London, 8 p.m. Trade Nuisances, by Prof. A. Bostock Hill, M.D., D.P.H., F.I.C.

19 S. Inspection and Demonstration at Knacker's Yard, Whitechapel.

22 T. Lecture to Sanitary Officers, London. Water Supply, Drinking Water, Pollution of Water, by Prof. W. H. Corfield, M.A., M.D.

23 W. Inspection and Demonstration at the East London Soap Works, at 3 p.m.

25 F. Lecture to Sanitary Officers, London, 8 p.m. Diseases of Animals in relation to Meat Supply: Characteristics of Vegetables, Fish, &c., unfit for food, by Alfred Hill, M.D., F.R.S.E.

26 S. Inspection and Demonstration at Richmond Main Sewerage Works, Mortlake, 3 p.m.

29 T. Lecture to Sanitary Officers, London, 8 p.m. Infectious Diseases and Methods of Disinfection, by Edward C. Seaton, M.D., F.R.C.P.

30 W. Inspection and Demonstration of Disinfecting Apparatus and Model Steam Laundry, at St. John's Wharf, Fulham, 3.30 p.m.

NOVEMBER.

1 F. Lecture to Sanitary Officers, London, 8 p.m. Principles of Calculating Areas, Cubic Spaces, and Interpretation of Plans and Sections to Scale, by C. H. Cooper, ASSOC.M.INST.C.E.

2 S. Inspection and Demonstration, College Farm, Finchley, 3 p.m.

5 T. Lecture to Sanitary Officers, London, 8 p.m. Sanitary Appliances, by G. Reid, M.D., D.P.H.

6 W. Inspection and Demonstration in the Parish of St. George's, Hanover Square, W., 2 p.m.

8 F. Lecture to Sanitary Officers, London, 8 p.m. Sanitary Building Construction, by T. Roger Smith, F.R.I.B.A.

9 S. Visit and Inspection of the Sewage and Destructor Works, Ealing, 2.15 p.m.

12 T. Lecture to Sanitary Officers, London, 8 p.m. Details of Plumber's Work, by J. Wright Clarke.

13 W. Inspection of the L.C.C. Common Lodging House, Parker Street, Drury Lane, at 3 p.m.

15 F. Lecture to Sanitary Officers, London, 8 p.m. House Drainage, by W. C. Tyndale, ASSOC.M.INST.C.E.

19 T. Lecture to Sanitary Officers, London, 8 p.m. Sewerage and Sewage Disposal, by Prof. Henry Robinson, M.INST.C.E.

20 W. Inspection of the L.C.C. Common Lodging House, Parker Street, Drury Lane, at 3 p.m.

22 F. Lecture to Sanitary Officers, London, 8 p.m. Scavenging and Disposal of House Refuse, by Chas. Mason, ASSOC.M.INST.C.E.

DECEMBER.

6 F. } Examination for Inspectors of Nuisances, London.
7 S. } Examination in Practical Sanitary Science, London.

11 W. Sessional Meeting at 8 p.m.

13 F. } Examination for Inspectors of
14 S. } Nuisances, Cambridge.

20 F. } Examination for Inspectors of
21 S. } Nuisances, Manchester.

EXAMINATIONS.

Examinations in Sanitary Knowledge for Inspectors of Nuisances—Proposed Examinations for 1896:

Plymouth	..	Friday and Saturday,		January	17th	and	18th.
Birmingham	..	„	„	April	10th	„	11th.
London	..	„	„	May	8th	„	9th.
Newcastle	..	„	„	June	5th	„	6th.
Cardiff	..	„	„	July	10th	„	11th.
Leeds	..	„	„	„	24th	„	25th.
London	..	„	„	December	4th	„	5th.
Liverpool	..	„	„	„	18th	„	19th.

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MEMBERS AND ASSOCIATES ELECTED.

From July to September, 1895, inclusive.

MEMBERS (Mem. San. Inst.)

* Passed Examination in Practical Sanitary Science.
‡ Passed Examination as Inspector of Nuisances.

918 1895. July. *Andrews, John, 105, *Mount Street*, *W.*
921 1895. July. ‡Debnam, A. W. J., *Town Hall*, *E. Stonehouse*, *Devon.*
919 1895. July. Johnson, Charles Thompson, assoc.m.inst.c.e., *Surveyor*, *Thornaby-on-Tees.*
920 1895. July. Morton, James S., m.b.dublin, d.p.h.camb., 21, *St. Mary's Terrace*, *Paddington*, *W.*

ASSOCIATES (Assoc. San. Inst.)

‡ Passed Examination as Inspector of Nuisances.

1162 1895. July. ‡Ashwell, Miss Mary Helen, 91, *Waterloo Crescent*, *The Forest*, *Nottingham.*
1175 1895. July. ‡Batchelor, R. H., 34, *Victoria Street*, *S.W.*
1166 1895. July. ‡Beams, Harry George, *London Road*, *Ewell*, *Surrey.*
1171 1895. July. ‡Blythe, Osborne, Jun., *Alnmouth*, *Northumberland.*
1167 1895. July. ‡Boucher, Arthur Charles, 83, *Greyhound Road*, *Fulham*, *S.W.*
1161 1895. July. ‡Budd, James, 14, *St. John's Road*, *Milton*, *Gravesend.*
1178 1895. July. ‡Catmur, Frank, *Stucley House*, *Antill Road*, *Bow*, *E.*
1163 1895. July. ‡Crosby, Andrew Percival, *Farnham*, *Surrey.*
1170 1895. July. ‡Crothall, Harry George, 26, *Aytoun Road*, *Brixton*, *S.W.*
1179 1895. July. ‡Dean-Pitt, Miss Louisa Grey, 39, *Earls Court Square*, *S.W.*
1181 1895. July. ‡Endsor, Henry Arthur, 22, *Stepping Lane*, *Old Uttoxeter Road*, *Derby.*
1191 1895. July. Heinemann, Charles Arnold, 17, *Ravenswood Road*, *Balham*, *S.W.*
1165 1895. July. ‡Jacobi, Miss G. B., l.r.c.p. & s. edin., 23, *Gray's Inn Residences*, *Holborn*, *E.C.*
1185 1895. July. ‡Johnson, Alexander, 23, *Warwick Street*, *Regent Street*, *W.*
1169 1895. July. ‡Killick, Anthony Edward, *Oldenbury House*, *Tunbridge Wells.*
1176 1895. July. ‡Lake, John, 95, *High Street*, *Guildford.*
1159 1895. July. ‡Marshall, William Gray, 7, *Tyler's Avenue*, *Southend-on-Sea.*
1164 1895. July. ‡McCarthy, Frederick William, 20, *Chepstow Place*, *Bayswater*, *W.*

1174 1895. July. ‡Oliver, David Ernest, 22, *Theberton Street, Islington, N.*

1173 1895. July. ‡Phillips, Alfred James, *Lindenhurst, Southcote Road, Bournemouth.*

1158 1895. July. ‡Pond, Joseph, 34, *Faroe Road, W. Kensington, W.*

1190 1895. July. ‡Quinton, John T., 14, *Craggs Street, Stockton-on-Tees.*

1164 1895. July. ‡Read, Miss Emma, *St. Ives, Cornwall.*

1163 1895. July. ‡Savage, William, 95, *Doncaster Road, Barnsley.*

1186 1895. July. ‡Shepherd, Arthur James, 48, *Lingham Street, Stockwell, S.W.*

1160 1895. July. ‡Sheraton, John, 14, *Marlborough Street, Seaham Harbour.*

1188 1895. July. ‡Simpson, Frederick Arnold, 67, *Tottenham Court Road, W.*

1162 1895. July. ‡Smith, Harry, 5, *Elmsleigh Road, East Hill, Wandsworth, S.W.*

1168 1895. July. ‡Stillman, William George, 27, *Albion Road, Tunbridge Wells.*

1167 1895. July. ‡Thurgood, Miss Bertha, *Rookwood, Abbess Roothing, Ongar, Essex.*

1177 1895. July. ‡Treharne, Evan, *Church Cottage, Ton Pentre R.S.O., Glamorganshire.*

1172 1895. July. ‡Watson, William Ben, *Eastfield*, 2, *St. Mary's Road, Leamington.*

1180 1895. July. ‡Wreford, Walter James, 75, *Richmond Road, Barton Hill, Bristol.*

1180 1895. July. ‡Wright, Henry, *Town Hall, Hastings.*

OBITUARY.

JOHN SYER BRISTOWE, M.D., F.R.C.P., F.R.S.

(Member.)

The death of Dr. John Syer Bristowe has removed from our roll one of the most esteemed members of The Sanitary Institute, of which he became a member on the amalgamation of The Sanitary Institute of Great Britain with the Parkes Museum, having previously been a member of the latter body. For nearly three years he suffered from a lingering illness, and his decease at the age of 68 years is lamented by numerous friends and fellow workers as a loss to medicine both in its preventive and in its curative aspects.

Dr. Bristowe was a distinguished student of St. Thomas's

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Hospital and graduate of London University, carrying off numerous prizes, medals, and scholarships. He was elected a Fellow of the Royal College of Physicians, was for several years a Censor of the College, and ultimately Senior Censor. He was a Fellow of the Royal Society, and also an Honorary LL.D. of Edinburgh University.

As a physician Dr. Bristowe's reputation stood very high. At the time of his death he was Consulting Physician to St. Thomas's Hospital, having previously completed a service of thirty-two years as Physician, at the expiration of which period he was presented with a handsome testimonial, and a medal in pathology was founded at the Hospital. He was an Examiner in Medicine at the Royal Colleges of Physicians and of Surgeons, and at the Universities of Oxford and of London. He was a past President of numerous Societies connected with Medicine.

His profound pathological knowledge, to which branch of Medicine he contributed many observations, caused him to be regarded as a leading authority upon many questions of preventive medicine. He was a member of the Royal Commission on Vaccination, and from the date of the first Metropolis Local Management Act coming into force in 1856 until his death, he was Medical Officer of Health for Camberwell. He was one of the original members and a past President of the Society of Medical Officers of Health.

Of Dr. Bristowe's literary works, his treatise on "The Theory and Practice of Medicine" is more widely read and admired than any other, and is still after many editions a leading text-book. His volume of "Clinical Lectures and Essays on Diseases of the Nervous Systems" is also a valued contribution to the literature of this subject. In addition to these must be mentioned his Lumleian and other Lectures. His contributions, pamphlets, and articles were numerous and valuable, especially his papers in the Pathological Society's Transactions. His style of writing was flowing and lucid, and possessed a charm recognised by all those acquainted with his works.

The geniality of Dr. Bristowe's disposition communicated itself to all who came into contact with him, but never influenced the independence of his opinion, and the sincerity and integrity of his character will long remain a subject of admiration.

J. F. J. SYKES.

THE REV. C. G. K. GILLESPIE.

(ASSOCIATE.)

The REV. C. G. K. GILLESPIE, who was an Associate of the Institute, died on July 9th at Boston, Lincolnshire, aged 59.

He took so much interest in the sanitary welfare of the poorer parishioners under his charge, that a few years ago he came up to London and passed the Examination of The Sanitary Institute, in order that he might be able to advise and assist his people in matters relating to the health and sanitation of their homes. Among his other attainments Mr. Gillespie was a great linguist, speaking some fifteen different languages.

E. WHITE WALLIS.

LOUIS PASTEUR.

(HONORARY FELLOW.)

By the death of M. PASTEUR, not only the French nation but the world at large has sustained a heavy loss. Although M. Pasteur had reached the age of 73, there was in him no dimming of the intellectual powers, and no loss of that enthusiasm in the cause of science and humanity, which have made his name a household word in every quarter of the globe. It is a pity that his life could not have been longer spared, so that the world might have continued to benefit from those discoveries in bacteriological science to which the great faculties of his mind have been devoted during the later portion of his career. He has, however, left behind him a band of able and cultured men, trained under his own eyes, and instructed in those methods of research which originated with the master mind, and to whom we may look for the further elucidation of those problems in biological science, of which the solution will be forthcoming in the not remote future.

To the public Pasteur is, and always will be known as, the founder and exponent of the "germ theory of disease." But before Pasteur studied disease germs, he had spent many years of his life in investigating the mysterious—as they were then—processes concerned in the fermentation and putrefaction of organic matters. If he was not actually the first to show that micro-organisms are included in the scheme of nature, he did at any rate demonstrate what are the precise functions and actions of large classes of microbes, and that a knowledge of the life-histories and properties of these mysterious entities was of the greatest importance to such industries as brewing, grape culture, and silk-worm rearing. By the demonstration of the fact that putrefactive processes are the result of the action of microbes upon putrescible material, and that there is no spontaneous generation of microbes from non-living matter, Pasteur prepared the soil which Lister's brilliant induction has rendered so fruitful in operative surgery. To Lister we are indebted for

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the practical application to the living body of those principles of which Pasteur demonstrated the truth in organic cultures; and thus has the entire human race benefited. Antisepticism in surgery is not one of the least of the triumphs which Pasteur has won over the forces of animate nature.

To Pasteur Preventive Medicine owes more than to any other worker of the present age. Besides the researches above alluded to into the nature of fermentation and putrefaction—which at the time revolutionised all existent knowledge on the subject, and have proved of immense importance to Sanitary Science—there are Pasteur's investigations into the intimate pathology of many of the diseases of the lower animals, some of which are communicable to man. The discovery of the specific microbe—the *causa causans* of a disease—led on in the fruitful mind of such a man as Pasteur to the further discovery that disease-producing organisms could be weakened by appropriate methods, and that cultures of these weakened microbes might be made of service in warding off or arresting the very diseases which the virulent organisms induce. To Pasteur, then, we owe the science of preventive inoculation by attenuated viri, and also the latest developments of this science, the methods of chemical vaccination, or inoculation into the living body—not of the weakened organisms themselves, but of the chemical products of the growth of the organisms in nutrient media—the Antitoxins of every-day language. Anthrax, splenic fever, or malignant pustule in man, rabies or hydrophobia, tetanus, and diphtheria are the diseases with which Pasteur's name is most intimately associated in the minds of the public, as it is for these complaints that he has invented methods of preventive inoculation, from which so great an alleviation of human suffering and diminution of mortality is expected. Inasmuch as these methods of antitoxin inoculation are still on their trial, it does not become us to speak positively of the benefits which have accrued or will be realised by their use. But this at least may be said, that if Pasteur had never lived it is certain that our knowledge of the essential causes of infectious diseases would have been far less complete than it actually is, and the diminution which has taken place in the prevalence and mortality of some of these diseases during the past twenty-five years would still be for the future to accomplish.

In the practical application of Pasteur's discoveries to the requirements of domestic life, we have the filter which bears his name. The possibility of sterilising a liquid by filtration—depriving it of all organised life by this means—is now universally admitted. The results attending the adoption of this filter in the French Army in the practical eradication of enteric

fever are well known; and already the signs are apparent that there is near at hand in this country a complete reorganisation of those methods of domestic purification, of which the futility *quâ* protection from disease has been so clearly shown.

It is satisfactory to know that M. Pasteur met with a far more generous recognition of his services to science from his own countrymen than is usually accorded to distinguished scientific men in the United Kingdom. An annuity of 12,000 francs long ago awarded by the French Government, and the building of the Pasteur Institute in Paris at a cost of £100,000, and its subsequent partial endowment, are eloquent and satisfactory tributes of the estimation in which Pasteur was held by his own countrymen. This Institute, which is not as many people suppose, merely a place where preventive inoculations for hydrophobia are carried on, but is also a building admirably equipped with laboratories, in which the study of disease causation is assiduously cultivated, has served as a model of what such establishments should be to the remainder of the world, and has been extensively copied in other European cities.

M. Pasteur was the recipient of numerous honours from the scientific and learned societies of this country, and amongst other distinctions was an Honorary Fellow of The Sanitary Institute.

LOUIS C. PARKES.

EXHIBITS ADDED TO THE MUSEUM.

JUNE—SEPTEMBER, 1895.

DIVISION A.

SCIENCE IN RELATION TO HYGIENE.

Underground Water. Model showing the coned-shaped depression caused by pumping at a Well. This tank model is filled with sand to represent a porous stratum resting upon an impervious stratum, and water is filled in to represent the underground water. A well is sunk at the centre of the tank, and small trial tubes are sunk to give the level of the water at different distances from the well. These water levels are shown by the glass tubes outside which connect with the trial tubes. When the pump has not been working for some time the water is level in the well and in all the *trial* tubes. On the other hand, when the pump is worked the

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water in the well and in the trial tubes gradually sinks and forms a curved depression from each end of the tank towards the well, which is the lowest point of the depression.
J. Wallace Peggs, Assoc.M.Inst.C.E.

Bacteriological Specimens, including tube cultivations of diphtheria, sarcina, tubercle, malign œdema, prodigiosus, typhoid sacch. ellipsoid, pneumonia, tetanus anthracis. *Dr. R. T. Hewlett.*

Thermometer for ascertaining earth temperature. *L. Casella, Maker.*

DIVISION B.

Hygiene of Special Classes, Trades, and Professions.

Crematorium. Model in wood of the first Gorini Furnace, made for the International Congress of Hygiene at Paris.
le Dr. Prosper de Pietra Santa.

Plans, Sections, and Elevations of Artizans' Dwellings.
The East-End Dwellings Co., T. Wilkinson, Secy.

Artizans' Dwellings. Model prepared for the Parliamentary Committee on the London Streets and Buildings Bill, 1894.
London County Council.

Rudder Fastenings (Model) illustrating a method by which the rudder may be unshipped at sea for repairs.
J. B. Cullen, Inventor.

DIVISION C.

Construction and Sanitary Apparatus.

Closet, "Simplicitas," in section showing the application of "Metallo-keramic" joint. *Doulton & Co., Manufacturers.*

Closet (Model) with "Metallo-keramic" joint.
Doulton & Co., Manufacturers.

Water Storage Cistern (Model). Glazed fire-clay.
Broad & Co., Manufacturers.

Scullery Sink on Pedestals. Glazed fire-clay.
James Cliff & Sons, Manufacturers.

Yard Gully with diagonal outlet to allow of top fitting square with building. *J. W. Phillips, Inventor.*

Diagrams. Five coloured diagrams, mounted, illustrating defective traps, defective drain, defective interceptor, water supply, damp basement.

CONTRIBUTIONS AND ADDITIONS TO LIBRARY

During June to September, 1895.

*** *For publications of Societies and Institutions, &c., see under "Academies."*

In addition to the Books enumerated in the following list, many Pamphlets and Reports have been received from Prof. W. H. Corfield and Dr. Louis Parkes, also from le Dr. Prosper de Pietra Santa, all these latter relating to cremation.

ACADEMIES (American).

New York. *Academy of Medicine.* Transactions for 1893. Second Series, Vol. X. 686 pp., 8vo. New York, 1894. *The Academy.*

ACADEMIES (Australian).

New South Wales, *Royal Society of.* Journal and Proceedings for 1894. Vol. LXVIII. 368 pp., 8vo. Sydney, 1895. *The Society.*

ACADEMIES (British).

Guy's Hospital Medical School. The Dean's Report, 1894-95; and Syllabus Session, 1895-96. 81 pp., 8vo. London, 1895. *The School.*

Manchester and Salford Sanitary Association. Annual Report for 1894. 62 pp., 8vo, Manchester. *The Association.*

Royal Statistical Society. Journal, Vol. LVIII., Part II., June, 1895. 177 pp., 8vo. London, 1895. *The Society.*

The Institution of Civil Engineers. Minutes of Proceedings, with other selected and abstracted papers, Vol. CXXI., 1894-95, Part III. 462 pp., 8vo. Vol. CXXII., 1894-95, Part IV. 519 pp., 8vo. London, 1895.

——— Catalogue of the Library (3 Vols.). 1626 pp., 8vo. London, 1895.

——— Charter, Supplemental Charter, By-Laws and List of Members, 195 pp., 8vo. London, 1895. *The Institution.*

ACADEMIES (Continental).

Amsterdam, *Royal Academy of Sciences.* Verslagen van de Zittengen der Wisen Naturrkundige af deeling van de Koninklijke Akademie van Wetenchappen, van 26 Mei, 1894, tot 18 April, 1895. Deel III. 298 pp., 8vo. Amsterdam, 1895. *The Academy.*

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Albrecht, *Dr. H.* Handbuch der Praktischen Gewerbehygiene Lieferung 4. 147 pp., 8vo. Berlin, 1895. *Purchased.*

Basu, *Dharma, Surgeon.* Hygiene and Public Health in Bengali. Vol. II. 8vo. Calcutta, 1887. *The Author.*

Blyth, *A. Wynter.* Poisons: their effects and detection (3rd edition). 724 pp., 8vo. London, 1895. *The Author.*

Chicago. *Department of Health.* Annual Report for the year ended December 31st, 1894. 268 pp., 8vo. Chicago, 1895.
Dr. Arthur R. Reynolds.

Davies, *Surg.-Major, A.M.* A Handbook of Hygiene. 590 pp., 8vo. London, 1895. *The Author.*

Greenwich, The Royal Observatory. Results of the Magnetical and Meteorological Observations made in the year 1892, under the direction of W. H. M. Christie, M.A., F.R.S., Astronomer Royal. 157 pp., 4to. London, 1894. *The Astronomer Royal.*

Hamburger, *Dr. H. J.* Ueber die Reglung der Asmotischen Spannkraft von Flüssigkeiten in Bauch-und Pericardialhöhle. Ein Beitrag zur kenntniss der Resorption. 96 pp., 8vo. Amsterdam, 1895. *Royal Academy of Sciences, Amsterdam.*

Haviland, *A.* The Geographical Distribution of Disease in Great Britain (2nd edition). (Two large maps accompanying.) 406 pp., maps, 8vo. London, 1892. *The Author.*

Hong Kong. Report of the Director of Public Works for 1894. 23 pp., f.cap. Hong Kong, 1895. *Francis A. Cooper.*

Husband, *Dr. Aubrey.* The Student's Handbook of Forensic Medicine and Public Health (6th edition). 692 pp., 8vo. Edinburgh, 1895.
E. & S. Livingstone.

Jeannel, *Dr. J.* Mémoire sur la Prostitution Publique et Parallėle complet de la Prostitution romaine et de la Prostitution contemporaine. 241 pp., 8vo. Paris, 1862. *Rev. T. R. Maynard.*

John, *Johann Dionis.* Lexekon der K. K. Medizinalgeseke (2 Vols.). 486 pp., 8vo. Prag 1796; 724 pp., 8vo. Prag, 1798.
Charles Siebreich.

Kaye-Parry, *W.* The Application of Recent Advances in the Study and Treatment of Sewage. 28 pp., 8vo. Dublin, 1895.
The Author.

Lecour, *C. J.* La Prostitution a Paris et a Londres, 1789-1877. (Troisième Edition). 474 pp., 8vo. Paris, 1877.
Rev. T. R. Maynard.

Local Government Board. Dr. S. Monckton Copeman's Report on an outbreak of Diphtheria at Potterne in the Devizes Rural District. 17 pp., f.cap. London, 1894.

——— Dr. R. Deane Sweeting's Report on an outbreak of Enteric Fever at New Delavel, in the Tynemouth Rural District of Northumberland. 9 pp., f.cap. London, 1895.

Local Government Board. Dr. S. Monckton Copeman's Report on an outbreak of "Fever" in the Borough of Bury. 9 pp., f.cap. London, 1895.

——— Dr. Theodore Thomson's Report on an Epidemic of Enteric Fever in the Boro' of Newport, and in certain parts of the adjoining Isle of Wight Rural District. 22 pp., f.cap. Maps. London, 1895.

——— Dr. R. J. Reece's Report on the prevalence of Diphtheria in the Barnstaple, Bideford, and Ilfracombe Urban, and the Barnstaple and Bideford Rural Sanitary Districts, and on the sanitary condition and administration of those districts. 25 pp., f.cap. London, 1895.

——— Dr. R. Deane Sweeting's Report on an outbreak of Diphtheria at Llanfyndd in the Llandilofawr Rural District of Carmarthenshire. 8 pp., f.cap. London, 1895.

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LECTURES TO SANITARY OFFICERS.

TRADE NUISANCES.

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Delivered October 18th, 1895.

The first thing to strike one in considering this subject is the enormous number of trades from which emanations arise that can rightly be regarded as nuisances. If we refer to the Public Health Act we find that under the head of "offensive trades" only a few trades are mentioned by name; they are: Blood boilers, Bone boilers, Fellmongers, Soap boilers, Tallow melters, and Tripe boilers; although the Act generally speaks of "any other noxious or offensive trade, business or manufacture."

If, however, we come to consider the various modes of manufacturing nearly all articles, we find that unless certain precautions are taken, nuisances may arise from some processes which at first sight seem of the most innocent nature. Indeed, the number of possible trade nuisances is so great that I should hardly have time to mention them all by name in one lecture; so that I shall content myself with bringing under your notice a few of the more important from a sanitary point of view, and those which are most likely to be brought under the notice and jurisdiction of the Sanitary Officer. The classification of trade nuisances is very difficult, owing in many instances to their complex nature, but one has been effected by

Dr. Ballard, which at least has the merit of being convenient. It is as follows:—

I. The keeping of animals.
II. The slaughtering of animals.
III. Other branches of industry in which animal matters, or substances of animal origin, are principally dealt with.
IV. Those in which matters of vegetable origin are dealt with.
V. Those in which matters of mineral origin are dealt with.
VI. Those in which mixed matters—animal, mineral and vegetable—are dealt with.

Before considering the several processes in detail, and the modes of dealing with any nuisances arising, it is desirable perhaps to look at one question of general interest, *i.e.*, applying to trade nuisances as a whole, namely, how far can such nuisances be considered injurious to health? This is a question far more complex than it appears on the surface, as Dr. Ballard has well pointed out, because of the difficulty of eliminating from the enquiry the influence of other circumstances—some known, some unknown.

In certain trade processes emanations are given off of an absolutely poisonous nature, and the effects are clearly shown on those exposed to the poisonous fumes, *e.g.*, arsenic, or to irritating gases like hydrochloric acid or carbonic acid.

This of course applies chiefly to the workers, but in a less degree also to those who reside in the neighbourhood of works where such substances are used.

The general effects produced upon those in the neighbourhood of works where ordinary effluvia arise may be said to be nausea, perhaps vomiting, loss of appetite, headache, giddiness, a general depression or weakness, and malaise; and that such conditions are produced in some we have abundant proof. It must be remembered that the question of interest or otherwise in the works has a very important bearing on the subject, for while undoubted suffering is caused to those who look upon the works as an annoyance, and have no interest in them, the manufacturers themselves often point to the fact that their workpeople, who are more intimately associated with the effluvia, are not in any way inconvenienced. Dr. Ballard, in his admirable report, to which all who want the fullest information on this subject should refer, completely disposes of this argument. He shows first that in all good faith, employers are apt to forget those cases in which men have left their employ when suffering from ill-health, and have either gone to other occupations, or on *their* clubs as chronic invalids. Again, in many instances such

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precautions are taken in many works, that the effluvia arising are far more noticeable at a distance than they are in the works themselves. There is therefore but little doubt that trade nuisances are in many instances sources of ill-health to many otherwise healthy people exposed to their influence; much more then must they be injurious to weakly people and invalids, who are more easily affected by conditions tending to lower the standard of health. That such is the case is found to be the result of some years' experience, and we may assume, therefore, that as the result of theory and practice, any causes which tend to make impure, even in a small degree, the air we breathe, are potent means for lowering that vitality which it is the aim of sanitary science to maintain.

One more point in connection with this subject demands a moment's attention, viz., the allegation sometimes made that some effluvia arising from works are disinfecting in their character, and therefore a blessing in disguise. I have heard this statement made in all seriousness in the high courts, in relation to a nuisance arising from the making of charcoal. If, however, we consider for a moment that for these agents to be of any use as disinfectants they must be present in sufficient quantity to exert a deadly influence on the contagia, we see that the infinitesimal quantities diffused in the atmosphere can have no effects as disinfectants or germicides, but can only irritate and damage the health of the higher living organisms exposed to them.

I will now proceed to deal with the actual nuisances arising, and first draw your attention to

I. The Keeping of Animals.

Horses, or rather stables, only give rise to effluvia when improperly kept, either from insufficient air space around and inside the stables, or from a want of cleanliness in the stable, or on the ground adjoining it. If large stables, as is sometimes the case, are placed between long rows of houses, a persistent odour of ammonia is generally noticed, due to the decomposition of urine of the horses and the fact that the stable is improperly kept, and owing to the impossibility of thorough aëration and diffusion. Again, it is frequently found that in large stables no care is taken as to the early removal of dung and other filth, and while this remains and when it is being removed, intolerable nuisance frequently arises. Another cause of nuisance in stables is the improper character of the paving which allows soakage of animal filth into the ground. A favourite kind of paving being the rounded "kidney" stones, which being only laid on porous surfaces not only allow ground pollution to take place

but can never from the nature of them be properly cleansed. In addition to the public nuisance, it must be borne in mind that dwellings are often found over stables, and unless constructed with a due regard to the situation, all effluvia arising in the stable will pass into them to the detriment of the health of the dwellers. These people are generally horsekeepers or grooms, and though they may not see anything to complain about, the condition of their health and that of their families becomes rightly the care of the Sanitary Officer.

Cow keeping.—Nuisances arise from this trade from improper position of the cowsheds, improper construction of cowsheds, insufficient air space and ventilation for the cows, dirty condition of cows and sheds, storage of dung, &c., on or too near premises. Many cowsheds exist even in large towns which are not in any way a nuisance. Another cause of nuisance is the storage in improper receptacles and improper quantities of brewers' grains and distillers' wash, largely used for the feeding of cows in towns.

Pig keeping.—Everyone knows that pig keeping generally causes a nuisance if it be carried on near dwellings. This is not because the pig naturally is an unclean animal, but because it is kept and fed in such an objectionable way. The causes of nuisance are the filthy condition and improper character of the styes, and the nature, preparation and mode of storage of the food. The styes are generally unsuitable outbuildings, or else little huts made of wood and capable therefore of absorbing the filthy liquids abounding. They are rarely properly drained, sometimes all the excreta and filth being conveyed simply into a hole in the ground just outside the stye and allowed to soak away. The paving, if there be any, is absorbent, consisting of porous bricks or stones and not allowing of proper cleansing. As regards the food, this is generally stored in tubs, sometimes in brick pits; these are rarely, perhaps never, cleaned out, and containing as they do, all sorts of animal and vegetable matter in a state of decomposition and fermentation (for any thing is thought good enough to give to the pigs), when these are stirred up then a nuisance of the most offensive kind arises; and I have known cases in Rural Districts where the nuisance has given just cause of offence to people outside the farm and a considerable distance away, while no nuisance arose actually from the pigs themselves or their styes. Sometimes too nuisance arises from the boiling of offal in preparation for food. In order to shorten the subject I have refrained from mentioning under each head the means to be adopted to abate these nuisances, and will now therefore touch upon this important section of the subject.

From Horse keeping.—The paving should be impervious, and this is best effected by its being jointless. Ordinary bricks do not make a good pavement, if they are used they should be laid on rough concrete and laid in cement. The drain should be properly laid and discharge on to a trap outside. The dung should be removed at short intervals, and if straw or similar litter be used, it must be frequently changed or it becomes ammoniacal. I have found however that much of the effluvia arising from stables is done away with if peat moss is used as litter, as it absorbs and deodorizes all the urine. It is cheaper than straw, is soft and warm, and as a sanitary agent, deserves an extended use. Grooms object to it on account of appearance, but I feel sure that its use will be much extended in the future.

If there are any dwellings over the stable, the floor between them and it must be made impervious and the staircase to them must have no connection with the stable.

Cow keeping.—As in the case of keeping horses the nuisances arise from improper construction of cowsheds, from uncleanliness and the improper storage of food. Cowsheds rarely give enough space, each cow should have at least 800 cubic feet, though in some sheds they do not have 250. The sheds should be built of impervious material and be properly ventilated. The paving must be impervious and the drainage good; no dung should be allowed to be stored inside the shed, nor should it be stored for any length of time near, it should be removed as quickly as possible.

The feeding troughs should be of iron and be kept clean, while there should be an ample supply of water *within* the shed so that cleanliness may be practiced. There should be sufficient air-space round the shed. Grain if stored should be kept in brick pits or other non-absorbent vessels, and be protected from the weather, and these pits must when emptied be thoroughly cleansed, or the acetous fermentation will cause an intolerable nuisance.

Pig keeping—requires great care if carried on near dwellings. No wooden styes should ever be allowed and of course cleanliness both of stye and food is of the highest importance. Pigs and their litter should be cleansed daily, and every part of the stye should be of an impervious material; the drainage must be good and the food or wash should be stored only in proper vessels and not at all if sour or offensive, and in no case should pigs be kept within forty feet of a human habitation.

II. The Slaughtering of Animals.

This very important branch of trade unless properly carried on is a fertile source of nuisance. It is carried on in public

slaughter-houses or abattoirs and also in private slaughter-houses, and it is to these latter I would direct your attention. These private slaughter-houses are generally close to butchers' shops, and indeed in some places the operations are performed in the shop itself. I need hardly say that any such proceeding should not be tolerated. The nuisance arises from two main causes, the keeping of the animals prior to slaughtering, and a want of cleanliness in the slaughter-house after the operation. It is important then that specific precautions to prevent nuisance should be adopted. (The bye-laws issued by the L. G. B. as to structure should be referred to.)

In addition to this the occupier must provide proper vessels for catching and receiving blood and offal, and these must be removed from the premises on the same day, and he shall, as far as possible, prevent blood and offal gaining access to the drain or sewer, and the blood pit should not be only cleansed, but disinfected. The butcher as a rule has no difficulty in getting rid of the blood and offal. The blood is used as food, also in Turkey-red dying, while the guts are fetched by the gut-scraper, and the horns, hoofs and skins are all easily saleable.

The Slaughtering of Horses.—This comes into the same category as slaughtering beasts, &c., but as a nuisance it is likely to be more serious, first because the material operated on is generally diseased, and emanations arising from it are likely to be more injurious to health; and secondly, because in addition to slaughtering the knacker nearly always prepares, by boiling, offal and flesh as food for cats and dogs. The knacker also receives as part of his business dead carcases, and nuisance may arise from these before proper disposal. (The regulations made by the London County Council should be referred to.)

III.—Industries in which Animal Matters are dealt with.

The Frying of Fish is a very general operation in the poorer portions of large towns, and gives rise to considerable nuisance to those classes of people who do not buy the fish. The nuisance arises from the fumes from the oil in which the fish is fried (generally cotton-seed oil). It is very far reaching and not easy to abate. The operation is generally carried on in a small shop on an open fire. The plan usually adopted to abate the nuisance is the provision of a hopper over the dish connected with the chimney, but as this cannot be brought right down, at least in front, where it must be open for observation, draughts frequently cause the fumes to be blown about. The chimney should be so constructed as to have a good draught, and it should be carried up above the neighbouring houses.

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Trade of a Fellmonger.—This consists in receiving the skins of sheep and preparing them for the leather dresser. The skins received are of two kinds—fresh English skins from the butcher's, and foreign skins. The English skins are dealt with as follows: they are first beaten with a mallet, to detach any lumps of dirt, then soaked and washed with water. They are then limed, either in a pit or by being brushed over on the fleshy side with a *cream of lime.*

They are next hung up, either in a yard or in a warmed room, for the purpose of having the wool loosened. The wool is then removed by hand and placed in bins, when afterwards the skin, or *pelt* as it is now called, is thrown into a pit of milk of lime, where it remains till it goes to the leather dresser. Foreign skins being hard are first soaked in water for several hours, and after the "*burring*" of the wool is completed, are hung up *to taint*, by which the wool is loosened. They are not *limewhited.* The chief sources of nuisance in this trade are: (1) The reception of raw skins from the butcher's. (2) The odour arising from the limed and drying skins. (3) The emptying of the pits. (4) The storing on the premises of used and waste lime. (5) The odour arising from dirty yard soaked with organic matter. (6) The nuisance caused below the works when the washing is done in a running stream.

It is easy to see that no nuisance need occur in this trade, *i.e.*, no nuisance beyond the works and yard; cleanliness both of the skins and wash-water, which should be changed once or twice a day, is essential. The waste lime should be removed in covered carts at once, while the yard should be properly paved and kept clean.

Leather Dressing.—Sometimes this is used in the same sense as tanning, but as a rule this trade only deals with sheep skins or pelts, and the tanner with bullock's hides.

The pelts are first "fleshed" or cleaned with a double-handed knife, so as to remove all pieces of tissue. They then go into pits containing milk of lime, first used weak and afterwards stronger, the process lasting some days. Then they are cleaned in tanks of water, being as a rule kept in constant motion; finally they are "puered" or soaked for some time in a solution of dogs' dung, which in winter is warmed, and is of course horribly offensive, after which they are tawed or tanned. Nuisance may arise from dirty surroundings, improperly paved yards and floors, and from the operation of puering; this latter should only be carried out when the stench arising is carried away by flues and shafts out of reach of houses or public roads.

Tanning—may give rise to serious nuisance, the processes carried on are as follows: hides which may be (1) fresh

English; (2) salted hides; (3) dry hides or "kips; are first of all "*limed*" or soaked in pits containing lime and water, then "*unhaired*," *i.e.*, the hair loosened by the lime is removed. It is then "*fleshed*" or has the loose inner tissue removed, the fleshings being sent to the glue maker. "*Rounding*" then takes place, *i.e.*, the irregular parts about the shoulders are cut off and sent to the glue maker. They are now termed "butts." Next the butts are soaked in clean water for a few hours to remove lime, and are then put into the "graining pit" which contains a solution of pigeons' or fowls' dung, or sometimes even a solution of weak ammonia, this softens the butts as "puering" softens the pelts.

"*Scudding*" is the next process. The hides are placed on the beam and are cleaned with a knife like an unhairer, and are finally shaved with a razor-like instrument to remove the fine hairs.

"*Splitting*" of those hides that are to be split is now performed, when the final process of "*tanning*" proper is commenced. This consists in soaking the butts in pits containing old tan liquor which is of course comparatively weak, then in pits called "floaters," which contain tan liquor of gradually increasing strength, until they are placed in dusters, *i.e.*, pits containing very strong bark liquor with crusted bark sprinkled over the top. This process takes time, the whole operation lasting about ten months. The substances used are oak bark, mimosa bark, valonia, catechu or gambier. The sources of nuisance from tanneries are as follows: (1) Offensive hides, generally cured foreign hides. (2) Old "soaks" which are only occasionally cleaned, and are generally very offensive. (3) The handling of the hides when changing them from the pits. (4) The scraping processes. (5) The running of old "soaks" into drains or sewers. (6) The destruction of the waste tan by burning.

The remedies are plain: 1st, the removal of hides to the tannery should be in covered carts only, while it is probable that much good would result by disinfecting the fleshy side of the hide; this indeed has been done. Old soaks might be disinfected when being cleared out, sulphate of iron being used, while it is more than doubtful if the use of old soaks is of any advantage to the tanner. Cleanliness of the yards must be insisted on, while if the waste tan is burnt it must not be in heaps, but either under the boiler fires or in an oven constructed for the purpose, connected with a tall chimney shaft.*

* The waste tan is now sometimes passed through a press, dried thereby, and sold as litter for animals.

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Chamois leather making sometimes causes nuisance from the fish oil used in its manufacture, and when the skin is dried in a chamber the odour of acrolein is noticeable. Arrangements can be made by which the oiling is so carried on that the fumes are led into a shaft and carried away a sufficient height, or are burned in a furnace fire.

Glue making.—The materials used in this trade are: *(a)* wet materials, such as "spetches" or fleshings from leather dressers and tanners, ears of animals, portions of bones to which tendons are attached, &c.; *(b)* dry materials, damaged pelts (Australian), ox feet, horn "sloughs" (pith or core), clippings of parchment, &c. The first process consists of liming if they have not been so treated. Then the lime has to be got rid of by washing in tanks or pits. Then the pieces are boiled in large open pans of such construction that there is a false bottom to allow of the circulation of the liquid to prevent burning and to assist the straining off of the liquid glue, while the boiling is going on the pans are constantly stirred. When the operation is completed, the pans are allowed to cool and the glue is drawn off from the space below the false bottom along a wooden channel to troughs called "coolers," into which it solidifies into a firm jelly, which is finally cut up into blocks, and these are allowed to dry spontaneously in wooden sheds. The substance left in the pans is called "scutch." This is usually after removal sent to the manure makers.

Size is made in much the same way, the materials used depending on the use to which it is to be put.

Glue works are often a source of considerable nuisance, effluvia having been noticed at Bristol for nearly a quarter of a mile from the works. The sources of nuisance are as follows: (1) accumulations of "fleshings" where the deliveries of these are in excess of power to deal with them; (2) the effluvia from the boiling pans, which, if the materials are old and decomposed, is disgusting in the extreme; (3) the accumulation of "scutch," which sometimes goes on for long periods. Dr. Ballard describes the odour of an old accumulation of decomposing "scutch" as "ferocious and sickening"; (4) general effluvia arising from untidy works. It is not necessary that glue works should be a nuisance, and their mode of conduct to obviate this is well expressed in the bye-laws for their control, passed by the London County Council (*q. v.*).

The boiling of flesh, tripe, &c., and the preparation of *Neats-foot Oil.*—The boiling of flesh is usually carried on at knackeries in pans generally situated in the slaughterhouse, sometimes these are heated by open fires and sometime by steam thrown in, the fat is skimmed off and sent to soap boilers, while

the boiled flesh is placed on the floor of the slaughter-house and afterwards hung up to dry. The liquor is ladled out hot and thrown on to an open channel and down into a drain. *Tripe* is the first stomach of the Ox, and this is first cleaned and scalded and then scraped, generally by hand, it is afterwards boiled in open pans, the fat skimmed off and set aside. When the tripe is sufficiently cooked it is hung up to cool, and the boiling liquor is discharged into the drains.

Neats-foot Oil is made from Ox feet. These are washed in cold water and then boiled in open pans, when the oil is skimmed off the surface.

It will be at once seen that all these processes if badly conducted are likely to yield effluvia. The sources of nuisance in the establishments being: (1) the vapours arising from the boiling pans; these are specially bad at knackeries, particularly in close muggy weather; (2) the vapours arising from the boiled materials whilst cooling; (3) the vapours arising from the liquor running into the drain; (4) general untidiness and want of cleanliness of the place itself.

These nuisances can be dealt with as follows: in small tripe and trotter boiling places the boiling-pan should have a hopper fixed over it, and connected with a high chimney having a good draught; it will not do to allow the steam simply to escape through a hole in the wall at a low altitude. In larger places the lid should fit closely, and a pipe should take the vapours down beneath the fire-place, where they will pass through the fire and be consumed. The ash-pit of course must have a well-fitting door. For large establishments, such as knackeries, the plan adopted at Adams's, in Birmingham, is about the best. It is as follows: six boilers are arranged side by side, each having a wooden lid fastened tightly on. At the top of each pan is a pipe which connects with a ten-inch main pipe, and this is connected with a condenser outside the building. This condenser is about fourteen feet long, is made of sheet iron, and filled with coke, and is kept cool by being exposed to the atmosphere. It is inclined at an angle, and a pipe at its lower border leads away the condensed vapour. The upper end is connected with the chimney by two pipes. I should add that the boilers are themselves placed in a sort of closet, and when the pans require an examination a sliding door enables this to be made, while any issuing steam rises to the top and finds access through a waste pipe into the chimney. The second source of nuisance may be remedied by placing the flesh to cool in pans of cold water; while the third is obviated by allowing the liquor to cool before it enters the drain. As regards the fourth, cleanliness must be insisted on; while the

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processes should only be allowed in those premises properly paved and impervious, and structurally suitable, and having non-absorbent vessels for the reception of garbage and offal.

Fat melting and Candle making.—The materials used are kitchen fat, pig's fat, and butcher's fat, consisting of beef and mutton fat mixed. The following are the methods adopted: (1) if the fat is melted in an open pan, it is first cut up into small pieces; (2) these are then placed in the pan and heated, the pan being kept stirred by a workman with an iron stirrer to prevent burning.

The other plan consists in heating the fat by steam alone, or by steam, sulphuric acid having previously been added; when this is the case the boiler must be lined with lead, and as the ingress of the steam itself causes agitation no stirring is required. At other works the fat is melted in steam jacketed pans; (3) the rendering completed, the tallow is ladled out into open pans, sometimes after being strained; (4) the next process is the further pressing of the refuse left in the pans, generally by a screw or hydraulic press to further extract fat by which what is known as "*greaves*" is made.

The following are the sources from which nuisances may arise: (1) storing of old and rancid fat, this however never extends far; (2) the vapours from the melting pan, especially from those open ones heated by fire, when the stirring has been neglected and also when the fat is old and rancid; (3) during the ladling out, especially towards the end, as these portions are likely to become over-heated, nuisance may arise; (4) greaves pressing, as it is done while the tallow is hot enough to give out vapours; (5) filthy and dirty condition of premises and vessels, owing to the presence of stale and rancid grease.

It will be at once seen that all these nuisances are very easily prevented: (1) by using only sweet fat; (2) by steam melting. This should always be insisted on in towns, though fat-melters object to adopt the plan because they lose the profit to be obtained from the "greaves." If the fat is melted in open pans then these should have iron jointed lids and the vapours should be conducted as previously mentioned beneath the fire. If steam melting be adopted then the vapours can be collected by shafts and conducted into tall chimneys or through a fire, or as is sometimes done, a partial condensation may be first effected; this nuisance occurring from ladling out the fat can only be dealt with very partially by the provision of a hood over the pan; (4) the nuisance from "greaves pressing" can be abated by closely boxing up the press and leading the vapours to a shaft; while (5) cleanliness, scraping, washing, and lime-whiting will of course reduce the nuisance produced by untidi-

ness, &c., to a minimum, and at the same time in the end conduce to financial success.

Soap boiling or *soap making* used to be a very offensive trade previous to the introduction of British alkali, now however it can be conducted practically without nuisance, and when effluvia do arise it is chiefly in connection with the melting of fats, and this of course can be dealt with on the principles previously stated.

Blood drying, blood boiling, the manufacture of blood albumen.—These trades all tend to produce nuisance: (1) from decomposed blood being used; (2) the peculiar odour due even to fresh blood, but more marked when cleanliness is not observed; (3) effluvia from blood boiling, especially in open pans by fire heat, and when the blood is decomposed, and lastly from blood manure making, which is frequently carried on in the same premises. In populous places steam heat only should be applied, while perfect cleanliness and the ventilation of the works by mechanical means at the top into the shafts will prevent the diffusion of the stinking effluvia into neighbouring dwellings. (The bye-laws for regulating these trades, in force under the London County Council, should be referred to.)

Gut scraping, gut spinning, and sausage skin making.—This trade consists in the preparing of the intestine of the pig and sheep, by scraping, cleansing and twisting or spinning it, to form what is known as catgut.

The first operation consists in soaking the guts in water, or passing through them a stream of water from a tap, sometimes after this the "guts" are soaked for some days in brine. The process of scraping is performed either with a wooden scraper, or the back of a knife, so that all the soft parts are detached. The guts are then further soaked, and if they are intended for use for sausage skins they are simply packed in salt in barrels and sent away. If, however, they are to be made into catgut, they are sewn together and twisted on a spinning wheel into cords of the required thickness. If intended for use as violin strings, they can only be made from the finest and freshest guts. It is quite obvious that the sources of nuisance arise: (1) from stale and offensive guts; (2) from dirty and unsuitable workshops, and (3) from improper storage of waste material. (The bye-laws in operation in London to govern these trades should be referred to.)

Unless one has had experience of the disgusting nature of the stench arising from some of these places, it is quite impossible to realize it. Dr. Ballard says, "Speaking generally, gut scraping and gut spinning establishments are the most intolerable of nuisances, wherever they may chance to be

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located. Within the workshops the stench is inconceivably horrible; few persons unaccustomed to it could bear to remain for a single minute in some scraping rooms."

In some of the large towns these businesses have become so objectionable that the smaller men have removed to rural districts outside the town, where in a shed in a field they have commenced operations. I myself have had personal experience of these in rural districts and have seen the horrible nuisance they will create hundreds of yards away. In one case I remember a nuisance was caused through the waste water going into the sewer, producing a nuisance through the sewer ventilators, nor was this all, the sewer a small one, owing to an insufficient supply of water for the work, was partially occluded by the decomposing solid animal filth which was allowed to pass into it. Without special order from the Local Government Board, a rural authority has no power to make bye-laws to enforce a proper carrying on of this very offensive trade.

Bone boiling.—This is a trade which is at times productive of serious nuisance: (1) because stale and putrid bones are conveyed and stored, and (2) during the boiling the steam is very offensive, while the bones after boiling, if heaped together as they generally are, give rise to a nasty ammoniacal odour, which is offensive and persistent. The way to obviate these sources of nuisance is first of all the conveyance of the bones in closed receptacles, tarred bags are highly spoken of, and the boiling of them by steam jacketed pans. If boiled by fire the steam must be conveyed by suitable pipes from the boilers into a shaft and either burnt or diffused in the air at a good altitude. The bones after boiling while they are stored should be covered over by tarpaulins so that exposure to the weather is lessened. Or they may be dried in a suitable chamber after withdrawal from the boilers, by means of coke fires, the steam being allowed to escape or being condensed.

The manufacture of artificial manure.—This perhaps is one of the largest industries which give rise to nuisance, and the processes and materials employed are very numerous. The chief varieties are the phosphatic nitrogenous and saline. The phosphatic are derived from coprolites, phosphorite, and other minerals, bones, guanos, char dust from sugar refineries, sugar scum, &c. The nitrogenous materials are blood, animal flesh, guano, shoddy, scutch, and sometimes night soil. The saline are common salt, sulphate of ammonia, nitrate of sodium, &c. Most of these manures are made by the agency of sulphuric acid. The acid used is generally the crude chamber acid made from pyrites, and containing therefore arsenic in variable quantity, the amount sometimes being large, and this must

be borne in mind in considering the nature of the vapours given off.

In the making of superphosphate, the coprolites are first powdered, or bones if they are used, crushed and then mixed either separately or together with sulphuric acid. This process is always done under a shed, and this is as a rule lighted and ventilated from the top. Mixing is done in two ways, by hand or mechanically. The mixer generally consists of a covered vessel raised from the ground or on an upper floor, sometimes it is quite closed but sometimes only partially so; the acid is generally run in from a tank on a higher level, the mixing usually takes about four or five minutes. A pasty mass is formed which runs out of the mixer into the "*hot den.*" This is generally a brick chamber with a paved floor. In this den the manure remains to set and the time varies from twelve hours to three or four days. It is then dug out and removed to another part of the building. As a result of chemical action great heat is produced, exceeding 200° F. The vapours given off contain a large quantity of moisture and also fumes of a compound of fluorine, silicon tetra fluoride, and these are decomposed by the moisture into hydrofluosilicic acid. Other common manure making processes are as follows:—

Dissolved Guano is made by acting on Peruvian guano with sulphuric acid; the process is practically the same as for superphosphate, but in addition to the gases given off in that manufacture, organic vapours of an unpleasant kind are evolved.

Leather, shoddy, fish, blood, and scutch are also acted on by sulphuric acid for the purpose of manure making. While in some places human excreta are converted into a poudrette, first of all by condensation after the addition of a little sulphuric acid to fix the ammonia, and then sometimes by the addition of superphosphate.

The offensiveness of manure works varies immensely with the structure of the works and the precautions taken to abate nuisance, and also with the materials dealt with. The nuisance may be reduced to a minimum—*e.g.*, Proctor & Rylands, in Birmingham, right in the most populous part of the town (and very large works), is hardly ever complained of; but in some instances works have proved vile nuisances at a distance of over four miles, and although it is difficult to prove actual or permanent damage to health, there is no doubt whatever that they are potent factors in reducing the vitality of those frequently exposed to their effluvia.

The sources of nuisance at manure works are: (1) the *reception* of raw material; (2) the preparation of this; (3) the process

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of manufacture or mixing; (4) the removal of the hot manure; 5. accumulations of the manufactured article.

(1). As a rule the great bulk of raw material is not a serious nuisance, though boiled bones often are, while shoddy, if damaged by transit, is apt to give off unpleasant odours.

(2). In the preparation of material we may have nuisance from bone boiling or flesh boiling.

(3). The chief source of nuisance, however, is nearly always from the mixing, where vapours both irritating and offensive are disengaged. If the manure is made in open vessels the nuisance is at its greatest, but it can be lessened, as I shall show, by the use of proper apparatus and other precautions.

(4). The removal of manure after mixing is also a serious source of nuisance, owing to the heat produced, and this can be obviated by the hot den, because this prevents the escape of the vapours into the air, if properly constructed.

(5). In addition to these processes, the storage of made manure causes at times great nuisance, especially in those cases where it is allowed to dry by spontaneous heating, particularly in the case of scutch manure works.

The following are the methods found most effectual in dealing with these nuisances:

1. *Storage and reception of material.*—This must, from the very nature of the works, be frequently offensive, and a great deal can be done to improve affairs by transporting all offensive matter in closed tanks, drums, or carts. The heaps of material may be covered up when stored, with earth or charcoal or other material; while night-soil should be kept in close tanks, and pumped up when required for use.

2. *The Preparation.*—This should only be done in closed chambers where the air is drawn off by means of a fan or shaft. When scutch is used it can be heated by steam in pressure pans, the fat extracted after it has cooled. Another plan is to heat it with steam and sulphuric acid and then express the fat by hydraulic pressure in a closed vessel while steam is injected into it.

3. The nuisances arising from mixing are dealt with in many ways. Some of the vapours are condensible by cold, some soluble in water, while others can be destroyed by fire. All processes are in actual use.

In superphosphate making the use of a *long flue* is sufficient to cause condensation and prevent nuisance, and this is adopted in Vickers's works in Manchester and at Morris and Griffin's in Wolverhampton, and in other places. These flues must be of great length to be efficacious, 200—250 feet, and even then fluorine and arsenic fumes are still recognizable.

Scrubbers or cascades are in use, notably at Newton's, in

Bermondsey, as a means of condensation. These are specially useful when there is no room for a long condenser. In this arrangement the vapours meet with a series of small streams of water, or cascades, falling from a tank and broken by a series of shelves; these in falling cause a vacuum and draw the condensible vapours from the hot den and absorb them.

The fire is important in those works where there are produced nitrogenous vapours, which are not condensible, and the fire or furnace is often super-added to condensing apparatus in such works, especially where fish, excrement, blood, or garbage are worked up.

At Proctor & Rylands', Birmingham, a flue takes up the fumes from the hot den and mixer, and then a fan forces these into an underground tank of water, constantly changed. Any gases escaping condensation are finally passed through the fire.

Dr. Ballard in his report before referred to, speaks approvingly of the long flue if properly constructed, and if the vapours are not hurried along it too fast. He also states that it is conclusively proved that good results are attainable from scrubbers or condensers, provided that they are not too small and the water is used in sufficient quantity.

4. The nuisance arising from the removal of the manure from the den or mixer is now the chief cause of trouble in manure works, as no good remedy has yet been proposed for this, Dr. Ballard suggests either that the manure should be allowed to remain longer before removal and so allowed to cool, and secondly that means should be taken to expedite the cooling.

5. The general nuisance arising from the works, other than in mixing, can be lessened by using closed buildings only, and drawing off the air by fans into condensers and furnaces: kiln drying should not be allowed on open kilns.

IV. Nuisances caused by dealing with Vegetable Matters.

Distillation of Wood.—Wood is heated or distilled for the production of charcoal and also for the manufacture of acetic acid, generally termed pyroligneous acid and "naptha" or methylic alcohol. Wood tar and creosote are also produced. The process adopted is generally as follows:—Wood in pieces is packed in iron boxes or trolleys and run into an oven, heated by fire, having an exit pipe through which the volatile matters and gases pass. Some of these are considerable and some are not. In the first place we have tar, water, and pyroxilic spirit, and in the latter chiefly gases of hydrocarbon nature. The plan generally adopted for condensation is the providing of nearly horizontal pipes which run backwards and forwards in a trough

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or troughs containing water. Sometimes, however, the water is omitted. The tar and liquids then run into an underground tank from which they are removed as occasion requires. The gases are usually burnt either under a fire or at the end of the escape pipe, or diffused in the air by means of a tall chimney.

The sources of nuisances are: (1) escape of fumes from the ovens, and although the quantity escaping is very small it is marvellous how irritating and penetrating it is; (2) the escape of fumes during the drawing of the ovens; (3) the escape of some of the fumes from the condenser, however well it is constructed; (4) the nuisance caused by the after treatment of some of the products, especially the tar, which is further distilled for the purpose of making naphtha and pitch.

These nuisances, although easily abated in theory, are very difficult to abate in practice, and I have known of one case where a most intolerable nuisance was created at a country house half a mile away from works conducted on fairly good principles.

The modes of abating the nuisances are as follows:

(1). Careful construction of ovens and careful luting of doors during heating.

(2). Careful drawing of charges and luting *at once* the lid of each box.

(3). The burning of incondensible gases preferably beneath a furnace.

(4). The provision of a proper closed and ventilated place for the distillation of tar and the drawing of the charge.

Oxalic acid making is sometimes complained of as giving rise to nuisance. Sawdust is heated with caustic alkali in a pan and kept stirred, when the whole has been boiled down to a paste it is removed from the pans to a drying floor. The mass is lixiviated or washed with water and crystallized. It is then boiled with lime by which oxalate of lime is formed, and this is decomposed with sulphuric acid and the solution of oxalic acid is crystallized. To oxidize colouring matter a little nitric acid is sometimes added.

Unpleasant vapours are given off in the first part of the process, which are sometimes described as "sickly." Pungent and irritating fumes when the oxalate is boiled with sulphuric acid, and lastly when nitric acid is used to bleach, nitrous fumes are evolved. These nuisances can be prevented by covering the pans in such a way that the fumes will be aspirated into a condenser or scrubber, or diffused from a tall chimney.

Paper works are productive of nuisance in two ways: (1) by boiling esparto grass with alkali with the subsequent recovery of the alkali; and (2) by the pollution of streams with lime or

organic refuse. When esparto grass is boiled with soda, both the first boiling and the subsequent wash water have an odour said to closely resemble senna tea.

The worst part of the nuisance, however, is that connected with the recovery of the soda, when this is heated in the open air and the resinous and other fumes are allowed to escape. Both these nuisances are easily remedied, the first by the provision of suitable boiling pans and a covered tank for the reception of the boiled charge, and secondly the provision of suitable evaporators for the recovery of the soda of which there are several now in use, viz., Rœckner's and the Porion-Davis. As regards the nuisance caused by polluting streams this depends very much on the relative size of the stream and the quantity of waste water. Near Birmingham, nuisance has been caused by waste water from a paper works where soda and esparto grass are not used. Lime is used with rags and some other materials, and the effluent after precipitation and filtration is run into the stream. No nuisance is caused at first, but further down secondary decomposition takes place, and effluvia rising from the stream are complained of.

Manufacture of India-rubber.—Nuisances arising from this trade have been reported at 300 or 400 yards from the works. They are due to the following four causes: (1) the boiling of the rubber, during which steam arises having sometimes a very offensive odour; (2) escape of fumes of naphtha in the processes of manipulating the rubber; (3) the steam discharged from the vulcanisers, after vulcanisation is complete; (4) the drying of the sheets of vulcanised rubber on steam chests after washing them, the odours given off being like those of burning India-rubber.

The first cause can be obviated by boiling the rubber in closed pans, the steam being either condensed or burnt in a furnace. The others by covering the spreading plate when naphtha is used by a box, the air of which is exhausted by a fan, and the naphtha either condensed by cold in a freezing machine or absorbed by oil. The general air of chambers containing naphtha can be drawn off by a shaft and fan, and discharged into a tall chimney.

Oil boiling, varnish making, &c.—Oils and fats are compounds of acids with glycerine, and when they are heated to a decomposition temperature a substance called acrolein is produced, which is extremely irritating to the eyes and nose. In various processes, such as oil boiling, varnish making, and floor-cloth making, this heating of oil and production of acrolein takes place, unless special precautions are taken to prevent nuisance. In many instances it is desirable to heat the oil in open pans,

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and even when this is done nuisance may be obviated by adopting the process of Messrs. Heywood & Lloyd. The pan is fitted with a funnel-shaped cover, in the corner of which is an outlet pipe; this is connected with a shaft in which a fan is worked, and all vapours are drawn off through it and are sent into a continuous pipe condenser, and then either through water or into the furnace of a fire; so that although the centre of the pan is open, no fumes escape through it owing to the strong inward draught caused by the fan in the outlet pipe. In some processes the fumes arising are subjected to a cascade in a scrubber, and are condensed in this way.

V. Nuisances caused by dealing with Mineral Matters.

The Manufacture of Coal Gas.—Coal is heated in closed retorts, and gas, water, tar, and ammonia pass off. The tar and water are condensed speedily with some of the ammonia, the gas or rather mixture of gases pass on first of all to the scrubbers where ammonia is absorbed, and then on to the purifiers, where the carbonic acid gas and sulphuretted hydrogen are absorbed by lime and oxide of iron. If carbon disulphide is also removed a special small purifier containing sulphide of calcium is interposed. It is of course a well-known fact that odours of an unpleasant type escape from all gas works, but if the processes are not carried on carefully the nuisance becomes unbearable.

The sources of nuisance are: (1) escape of smoke, &c., from the retort house; (2) the emptying of the purifiers; (3) the revivication of the oxide of iron; (4) the exposure of tar, &c., to the atmosphere; and (5) the removal of the various refuse substances from the works.

The first source of nuisance depends on careful charging of the retorts and the proper withdrawal of the charge after complete coking and the quenching of the coke. The chief nuisance is that arising from the emptying of the purifiers; this can be reduced by watering the lime first and carefully covering up with sacking all parts not actually being dug out at the time, and the reception of it into covered trucks and barges for removal. I have known serious nuisance to be caused at a gentleman's residence by the passing along the canal of gas-works material, even when the house was a long way off but situated on a higher level.

The manufacture of Sulphate of Ammonia.—In this process the "gas liquor" is mixed with lime and distilled ammonia is given off and received into sulphuric acid. Sulphate of ammonia is formed and crystallized out. As the gas liquor contains sulphide of ammonia, sulphuretted hydrogen is evolved, and this

is the main cause of nuisance from such works. It may be abated in two ways: (1) by burning the sulphuretted hydrogen, when it will be decomposed into water and sulphur dioxide; this, however, is itself a pungent and irritating gas and must be sent into a high chimney or else it will cause serious nuisance; (2) It (sulphuretted hydrogen) may be absorbed by chemical agents such as lime or oxide of iron mixed with sawdust, although in the latter case precautions have to be taken to counteract the effects of the heating which takes place.

Distillation of Tar.—In this trade coal tar mixed with more or less ammoniacal liquor is distilled. There are four products: (1) light oils; (2) heavy oils or creosote oils sinking in water and containing carbolic and cresylic acids; (3) anthracene oil, still heavier; and (4) pitch. The causes of nuisance are as follows:

1. The transference of the tar in uncovered barges and tanks, the chief odour arising from sulphide of ammonium.
2. The escape of offensive distillation products, mostly coming off at the end of the distillation.
3. The escape of a dense white vapour from the pitch being run off while hot.
4. The escape of offensive vapours from the pitch oven.
5. The use of creosote oil as a fuel, where there are no proper arrangements for its consumption.

All these nuisances can be successfully dealt with by transference of the crude material in air-tight tanks, absorption of sulphide of ammonium by hydrated oxide of iron, passing the gases through water and burning up those that escape in a furnace fire, and the use of creosote oil only in properly constructed furnaces, and running the pitch into a closed tank to cool.

The manufacture of Carbolic acid.—The carbolic oil from tar distillation is treated with caustic soda which separates out the carbolic and cresylic acids from the tar oils. It is siphoned off these and the alkaline liquid is super-saturated with sulphuric acid. The acids separate, are ladled off and distilled by fractional distillation carried to dryness, a light coke being left in the retort. Nuisances are caused by the odour of carbolic acid, by the escape of offensive gases at the end of the distillation, and by removing the coke from the retorts. The odour of carbolic acid is reduced by receiving the condensed liquids into covered vessels, while the gases are condensed by a worm as far as possible, those not condensing being drawn by a steam injector into a solution of lime or water, by means of which sulphuretted hydrogen is arrested, while others are conveyed by a pipe into the ash-pit of a furnace.

Nuisance from the coke is prevented by completing the distillation and not removing the coke until it is cold.

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The manufacture of Alkali.—In this process sulphuric acid is made to act on sodium chloride when heated. Hydrochloric acid gas escapes, and is condensed by a scrubber in suitable towers. The salt cake left is treated with chalk and fine coal, when sodium carbonate and calcium sulphide are formed. This mixture is called black ash, and the soda is obtained from it by lixiviation with water. The residue is termed *tank waste*, and it is from this that nuisance, if any, will chiefly arise, because it consists of ill-defined compounds of calcium and sulphur, some of which by oxidation become dissolved in water, either from rain washings or other causes.

This waste can be utilised and the sulphur recovered, either by Mond's process, in which air is blown through the waste, when the sulphur compounds are oxidised to sulphite and sulphate. These compounds are washed out and treated with hydrochloric acid and steam, when sulphur precipitates and is collected. At the St. Rollox works, Glasgow, Mactear's process is in use. The waste heaps are permeated by springs, and the liquid coming away from them holds in solution calcic sulphite and hyposulphite. Hydrochloric acid is added, and the salts are decomposed, sulphur being precipitated and sulphur dioxide evolved. Any sulphuretted hydrogen evolved from the sulphide is decomposed by the sulphur dioxide, more sulphur being thrown down; so that provided there is enough hyposulphite no nuisance from sulphuretted hydrogen can occur, and if not this can be added in requisite quantity.

The manufacture of oil of vitriol.—Sulphur or iron pyrites is heated, and the sulphur dioxide fumes are conveyed into a leaden chamber along with steam and the higher oxides of nitrogen produced by acting on nitre with sulphuric acid. The acid collects on the floor of the chamber, and is evaporated down in glass retorts.

Nuisances may arise from the sulphur dioxide or nitrogen oxides escaping from the chimney, furnaces, or lead chambers, and during concentration of the acid, by breaking of a retort, but all these nuisances are easily obviated by proper fittings.

Manufacture of bleaching powder.—Chlorine, made in several ways, is conducted to chambers where lime is laid on shelves in thin layers, when it is absorbed by the lime, and the so-called chloride of lime produced. The sources of nuisance are: the escape of chlorine by leakage from the chambers and from the powder while packing in casks. This can be obviated by exposing the lime in one chamber first, and then by a fan driving the unabsorbed chlorine into another chamber, where it will combine with the fresh lime; or the chamber may be divided into two parts, and when the lime in the first part is

saturated, allowing the unabsorbed chlorine to act on that in the other compartment.

It has been proved that the transference to the casks need cause no nuisance, as the powder may be packed in the casks by means of a direct tube of sacking from the chamber where it is made.

Galvanizing Iron.—In this process iron is first cleaned by dipping in a bath of hydrochloric acid, and then dipped into a bath of molten zinc. If the iron were quite pure, hydrogen only would be given off, but owing to impurities in it (carbon and sulphur chiefly), vapours are given off which are sometimes a nuisance, while there is generally some nuisance from arsenical fumes rising.

These fumes are directly injurious to health, and should not be allowed to escape at a low level, as is generally the case, into the atmosphere. They should be abstracted from the building by mechanical arrangements into tall chimneys and so diffused into the higher layers of the atmosphere. The spent pickle always contains a large quantity of free acid and unless this is neutralized or removed in some way it will damage the masonry of the sewers or pollute the watercourse into which it is discharged.

Brick burning is a very common operation and frequently causes nuisance to those in the neighbourhood. When bricks are burnt in well constructed kilns, the nuisance is slight; when, however, "*clamp burning*" or the burning of bricks with breeze and household refuse in alternate layers is carried on grave complaints from smoke, sulphuretted hydrogen, and organic vapours of a disgusting kind are made, therefore this kind of burning should be prohibited in the neighbourhood of towns or collections of dwellings.

The last nuisance I shall bring before you is that of *Portland Cement making.*—Chalk and clay are ground together with water and made into a mud. It is then called "Slurry." This is dried and burnt in kilns, and it is the emanations from this burning which give rise to the trouble. These consist of carbonic acid and sulphuretted hydrogen, and sometimes hydrocyanic acid or some volatile cyanide, so much so that in a case at Southampton, the gravel in the neighbourhood was coloured blue from the production of cyanide of iron. In addition to this, solid deposits of soot and dust are also formed.

It appears that the most effective plan of doing away with nuisance is to discharge all fumes into a very high stack 150 to 200 feet in height.

And now, gentlemen, my task is done, no one is more aware than myself of its deficiency. I have endeavoured in the short

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time at my disposal to bring under your notice those nuisances which are most likely to be met with by the sanitary officer in the course of his daily work, and although he may have difficulty in proving in any particular case that a nuisance is causing visible injury to health, it behoves him to remember that the science of hygiene is simply the doctrine of cleanliness, and that it is therefore the first duty of all engaged in sanitary work to remove as far as possible all impurity and dirt, whether in food, air, soil, or water, as only by the most perfect attainable cleanliness can we hope to reach the ideal of the sanitarian, the *mens sanâ in corpore sano.*

Offensive Trades specified in Sec. 112 Public Health Act, 1875.

1. Blood boiler.
2. Bone boiler.
3. Fellmonger.
4. Soap boiler.
5. Tallow melter.
6. Tripe boiler.
7. Any other noxious or offensive trade *(ejusdem generis).*

Bye-Laws made by the Local Government Board with respect to the trades of:—

1. Blood boiler.
2. Blood drier.
3. Bone boiler.
4. Fellmonger.
5. Tanner.
6. Leather dresser.
7. Soap boiler.
8. Tallow melter.
9. Fat melter or extractor.
10. Tripe boiler.
11. Glue maker.
12. Size maker.
13. Gut scraper.

To these should be added—

1. Fish and bacon curers.
2. Flesh boilers (for cats' meat, &c.
3. Animal charcoal makers.
4. Artificial manure makers.

Methods of preventing nuisance from Offensive Trades.

1. *Solid* offensive refuse must be separated from liquid, the solid portions being removed in closed impervious vessels.

2. *Liquid* refuse must be conducted away by proper drains, deoderants being used.

3. *Vapours and effluvia* should be treated by a combination of the following methods (the particular combination depending upon the trade) :—

    1. Condensation by cold.
    2. Absorption by water, or chemicals.
    3. Destructive distillation by heat in a closed vessel.
    4. Combustion of all gases that can be burnt.
    5. Discharge of gases into the air at a great height.

INFECTIOUS DISEASES AND METHODS OF DISINFECTION.

By EDWARD SEATON, M.D., F.R.C.P.

(Fellow.)

Delivered October 20th, 1895.

You have already heard from Dr. Hewlett a very interesting lecture upon the subject of microbes ("particulate contagia"), which lecture makes a good foundation for what I am going to say to you this evening on the subject of Infectious Diseases. You will have learnt from him that the tendency of modern research has been to show that these diseases in some cases have been actually demonstrated to be due to specific microbes, and that it is against the existence of these specific pathogenic (disease-causing) organisms that you as Sanitary Officers have to wage war. I have to tell you some of the principal facts, that it is desirable you should be familiar with, relating to the origin and spread of infectious diseases. I need not say that in dealing with a subject of such wide importance my remarks will refer almost entirely to questions of general principles, and in dealing with the subject of Disinfection I shall restrict myself to the leading principles that you have to bear in mind in the execution of duties in regard to which you should always be guided by the expert opinion of medical officers of health. It will be interesting to you in the first instance to speak of the methods of classification which have been frequently adopted in books of Medicine and "Public Health."

Infectious diseases have some times been classified as infectious and contagious, distinctions being drawn between those diseases which are infectious and those which are contagious. In these days when we learn so much of the life-history of microbes this distinction may be considered more imaginary than real, the difference is in the actual methods by which diseased germs, or microbes, are conveyed into the system. In some instances the micro-organisms are conveyed into the system by inoculation, as for example—in Erysipelas and some other diseases known as "contagious," or by methods which, if not actually those of inoculation, are closely allied thereto. Diphtheria is a very good example of the diseased germ being implanted in the system by a process very much a-kin to inocu-

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lation. There are other diseases specially known as "contagious diseases" of a similar nature in their methods of transmission.

In typhoid or enteric fever on the other hand, we have an example of disease in which microbes are conveyed into the system some times from great distances by such vehicles as water and milk entering the system by means of the alimentary canal. And again, we may have particles of infection, small-pox or measles, conveyed some little distance by the air, and gaining access to the system presumably by the respiratory passages. In either class of disease, whether infectious or contagious, the microbes on which their existence depends, have, in many cases, been demonstrated to exist. These microbes are characterised by certain features, and by peculiar method of growth or development in the gelatine or other media used by the investigating bacteriologist, by which, with our present day knowledge, scientists and medical men are enabled to distinguish between them; and in some cases to diagnose the disease with which they have to deal.

Another method of classification is, according to the dangerous character of these diseases. In considering this, I must point out to you that there are two ways of estimating the danger. You may estimate the dangerous character of the disease from the point of view of the gross mortality, the number of deaths in the population it gives rise to. Whooping cough and measles must both be considered very dangerous diseases from this point of view. There is, however, another way of estimating the dangerous character of disease, and that is, by the liability to death from it which an attack denotes. The "morbidity" or deathly character of a disease, which depends on its intensity or type, may be quite distinct from its "mortality," which generally depends on the extent of its prevalence.

From this point of view some diseases are very much more serious than others. Measles may be either a malignant or mild disease; but it is usually of the mild type. A child attacked with diphtheria is very much more likely to die from it than a child attacked by ordinary measles or whooping cough. An unvaccinated child attacked with small-pox of a certain virulent type runs about equal chance of life and death. Typhus, though not such a serious disease for the very young, is terribly fatal for the old.

The most important classification however from our point of view, is in the infectious diseases according to their preventability by methods of sanitary administration, as known and practiced at the present day. From this point of view we are entitled to put small-pox at the very head of the preventable

diseases. With the proper use of vaccination no one need have small-pox, as the experience of our special hospitals has shown over and over again. Typhus fever we believe, and I think rightly, has become almost exterminated by good methods of sanitation. Typhoid fever has undoubtedly been diminished in this country by improvement and safeguarding of our water supplies.

On the other hand we have to confess that as yet we have not been able to indicate the best methods of limiting such widespread diseases as measles and whooping cough. Again in the case of influenza we have not yet sufficient knowledge of the various methods by which it originates and spreads, to enable us to exercise any control over it.

What you, as sanitary officers, will be concerned with entirely, are those diseases which have been shown to be more or less preventable.

In time, as preventive medicine and sanitary administration extends and develops, the list of these diseases will be increased. Even now the country has good cause to congratulate itself on the immense progress which has been made in the science of preventive medicine, under which term I include methods of administration, which have contributed in no small degree to the diminution of the death-rate from infectious diseases during the latter part of the 19th century. Legislation has been based mainly upon the classification of which I have just been speaking. The Notification of Diseases Act relates entirely to the preventable diseases. It was introduced by the authorities of some of our large towns in the first instance between 1875 and 1880. As the result of the experience thereby gained the system extended, and the Infectious Diseases Notification Act was in 1889 passed into law. Although not a compulsory Act it was soon adopted by a very large proportion of the sanitary authorities of England, less than one-sixth of the population being at the present time without the scope of its provisions. This Act includes in its list, small-pox, cholera, diphtheria, croup (a disease allied to diphtheria), scarlet fever (scarlatina), typhus fever, enteric or typhoid fever, relapsing fever, continued fever, puerperal fever, as diseases which it is compulsory that medical men and householders should notify to the sanitary authority. It is also open to the authorities, by notice, to include certain other diseases in the list, and recently considerable discussion has taken place as to whether it is not desirable, having regard to the terrible effect of Asiatic cholera, to include acute, rapidly fatal cases of diarrhœa or English cholera which occur in the summer months and which often are of ominous portent. The Government Medical Authorities

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would then have ample warning and be able to organize its measures of defence. Chicken-pox is also a disease which in certain circumstances it is important to have notified on account of the difficulty there is of distinguishing cases of this disease from the slight modified attacks of small-pox, which under our present system of general vaccination occur during times of small-pox prevalence.

I would again impress upon you that the list that I have given is not necessarily steadfast. It may be extended or lessened as circumstances indicate from time to time. The main principle to be held in view is the same, viz., in considering the desirability of the notification of diseases on public grounds we have to take into account mainly their preventability. The mortality caused by diseases such as measles and influenza may be very great, and yet it may not be possible to show how they can be reduced by any measures of public health administration as known and practised. At the same time we always have to keep in view the desirability or necessity of extending our knowledge of preventive measures by trial methods. The basis of all preventive measures is the same. It rests upon the knowledge of the common or ordinary methods by which diseases, as we know them now, are transmitted from person to person, or of the circumstances which favour what is called epidemic diffusion. It is desirable therefore that I should give you some of the well known facts in regard to these ordinary methods of transmission of infectious diseases. It would perhaps be well if I should note them as set down in the syllabus of this lecture: infection of air, water, soil, food, lower animals, rooms, clothing, and the direct convection of disease by persons or things.

First, *Air*.—Diseases are transferred from one person to another in the ordinary course of business and social life. We have, unfortunately, too many examples of diseases spread in this way. I say unfortunately because they belong to the class which it must always be exceedingly difficult to prevent. Influenza, probably is a disease propagated in this way. Measles, we know, is easily propagated by means of the respired air, and it becomes exceedingly difficult, as every mother knows, however careful she may be in watching her child, to prevent its contracting a disease which is so widely prevalent. Small-pox is another example of disease spread by air, and as some authorities believe, to a very great distance. It is, however, well to bear in mind that this disease has undoubtedly shown itself to be controllable, to a certain extent, by means of isolation. Typhus fever is perhaps the best example of all air-borne diseases. Yet this disease is, fortunately, easily

preventable, by the best of all methods, in the eyes of the true sanitarian, viz., by dilution of the poisonous atmosphere presumably containing the germs with an abundance of fresh air, and by the influence of sunlight. On some points the sanitarian has been accused of shifting his base or changing his position. In all work founded on good science, there must, of course, from time to time be changes in the bases of action, changes which are the necessary consequence of our advancing knowledge. It is not an overwhelming reproach that is thus directed against us. It, however, constitutes a good reason for being careful how we formulate our principles. Now in the case of typhus fever, there certainly has been no change of opinion since the time when the influence of sanitary measures upon this disease began to be appreciated; and if I may venture to predict there is probably little likelihood of any essential change of opinion in this direction.

There are still living physicians and medical officers who knew how this disease used to prevail in St. Giles' and other overcrowded districts of the metropolis. They witnessed its rapid disappearance under the benign influence of sanitation. It is a great triumph of sanitation that this air-borne disease is how becoming almost extinct in England.* Let me in passing give a word of advice which experience leads me to think is needed by those who come in contact with the disease, as a Sanitary Officer may do at any time in the course of his duty. I would urge upon you the necessity of taking every precaution possible to avoid inhaling poisonous atmosphere in a concentrated form. You should cover the air-passages with a good respirator, you should see that the poisonous atmosphere is diluted with fresh air as much as possible, with due regard to the safety and welfare of the sick person, you should avoid close contact as much as possible, and especially inhaling the breath of the sick person. It is want of care in these matters that has led to the loss of many valued lives. I would urge upon you the importance of prophylactic measures, as they are called, not only in this disease but in the case of diphtheria, of which I shall have something to say presently.

Water.—This is a vehicle by which disease is disseminated, and that most notably in the case of cholera and typhoid (enteric)

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* Dr. Longstaff's admirable address at the Liverpool Congress in 1894 should be studied by those who desire to learn specially about the effects of Town Improvements on the Public Health, and of the efforts of the London County Council to stay the distinctly retrograde movement which has taken place of recent years in the erection close together of huge blocks of "Model Dwellings" on the Flat system.

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fever. In two out of three small outbreaks of typhoid fever I have had to investigate lately, one of them was undoubtedly caused by infected water and the other in all probability was so caused. The outbreak at Worthing, in Sussex, as you know was a remarkable instance of water-borne disease.

Earth and Soil.—The influence of the earth and soil in the maintenance or development of infectious diseases has not yet been fully recognised. We know that malarial diseases and cholera and the acute form of diarrhœa, which is so prevalent and fatal to children in the autumn months, depend to some extent upon some conditions of the surface soil, and we also know the practical importance of laying the foundations of dwellings upon such sanitary systems as prevent the air of the soil being drawn up into the dwelling. This is a precaution which seems to be more important in some districts than others.

Food.—The method by which disease is conveyed into the human system is most important, and it is essential that you understand some of the leading facts relating thereto. Such a widespread and serious disease as pulmonary consumption or as it is called phthisis, may be due originally to the eating of meat, the flesh of animals affected with tuberculosis, or it may be caused by the meat of animals whose flesh is in a sound condition but which has been contaminated by the knife of the butcher. This constitutes a strong argument in favour of the inspection of animals about to be slaughtered, and of meat intended for food. It constitutes also a very strong reason for the institution in this country of a systematic inspection of slaughter-houses, and still better for the establishment of public abattoirs. Still more important perhaps is the influence of the milk of tuberculous animals, especially where the udders are at all affected in causing tuberculous diseases amongst children. Here again we have a very powerful argument for the systematic inspection of cowsheds and dairies, and the examination of cows whose milk is about to be used for the food of man.

Diphtheria and scarlet fever also furnish us with examples of diseases which are occasionally conveyed by means of milk, and this not only as in the case of typhoid fever by some contamination of the milk with dirty matter of human origin; but, possibly, also by some condition of the animal itself which yields the milk. So that you will understand that in these diseases it is very important that researches should be made by medical officers under whose instructions you act, and also by competent veterinary authorities into the conditions of the health of the cows. When I first became a medical officer of health, twenty years ago, I took my ideas from standard works, and I believed those two last named diseases, diphtheria and

scarlet fever, especially scarlet fever, were always propagated by direct infection from one person to another, or by means of clothing. But I am sure now, that those sources of infection have been a good deal over-rated in the past. At that time we were not acquainted with the important part that milk and food played in contributing to the number of cases which occurred year by year of scarlet fever, diphtheria, and typhoid fever. I am convinced that we ought to look more and more to food as the source of these and some other diseases of which consumption and the tuberculous diseases of children are the most important.

As to the part the lower animals have had to do with the conveyance of infectious diseases, I have already referred to the way in which diseases may be generated and propagated by means of diseased meat or infected milk. I must not forget to mention to you that it is very possible other animals play a part in the spread of diseases, not only as simple carriers of infection, as in the case of the pet dog or cat kept in the sick room of an infectious patient, but also directly by diseased conditions common to animals and man. It is believed that cats and poultry have both played a part in the propagation of diphtheria, and our knowledge in this direction may not unlikely be extended. The rarer diseases of glanders, hydrophobia, and the woolsorter's disease, anthrax, are not so immediately important for discussion.

Rooms and Clothing.—Perhaps one of the most important subjects on which I ought to dwell on the present occasion, seeing that it has to do with the every day work of the sanitary officer, is the influence of rooms and clothing in the maintenance and spread of the disease. I have already referred to the fact that the standard works on medicine in its Public Health relation, of which Sir Thomas Watson's book was the most famous, dealt with this as the one common, almost universal, source of infection. In the case of the diseases of which I have been speaking, such as small-pox, typhus, scarlet-fever, &c., this is certainly one of the common methods of propagation. I have already given you good reasons for believing that this influence of rooms and clothing in the spread of disease by what is generally called in medical language Fomites (that is, fine dusty material which collects upon and adheres to structures and clothing) has been somewhat exaggerated in the past. Still its importance must never be under-estimated. No one, for instance, ought to underestimate the influence of clothing worn by a person in a room infected with small-pox, to spread disease. In the evidence given by a great physician, Sir William Jenner, before a Royal

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Commission on Small-pox Hospitals, more than ten years ago, he gave an example of how disease might be spread by the doctor who attends the patient in the exercise of his profession. I have myself gone through several epidemics of small-pox and have always made a point of taking such precautions as are practicable, by covering the clothing with a mackintosh or otherwise, to minimise the danger, and I certainly advise others to do the same. I would recommend all sanitary officers to have garments which will cover their ordinary clothing when they are engaged in an infected house or building. Sir Thomas Watson, in his famous work, gave many examples of how infection will cling to clothing for weeks, months, and even years. Simple exposure to the fresh air though valuable in itself was not enough to dispel the infectious element which attached itself to the clothing. Many were the examples of disease which had been undoubtedly propagated because the articles of clothing, or the things that were valued, had been retained instead of being destroyed, or effectually disinfected.

I feel inclined to dwell upon this point because, at one time in my career, it occupied my attention more closely. It occupied my attention continuously at a time when I was working with my friend, Dr. Ransom, in his experiments on the disinfection of textile fabrics. Some authorities, at that time, were disposed to scout altogether fresh air and sunlight as disinfectants. I have given you reasons for thinking that there is a good deal of truth in their contention that these must not be wholly relied upon. Still, I am bound to say that, with the advance of scientific knowledge, we find that nature does provide as it were for purification by methods such as these. We have a striking example of this truth in the purification of streams and rivers that is constantly going on by purely natural processes, the intimate character of which science is now revealing. So that I would venture to say, addressing you at the present day, you should never underestimate the valuable effects of soap and water, cleanliness, fresh air, and—not less important—sunlight in the work of disinfection.

That they are not to be relied upon wholly we know for a fact, and perhaps the best illustration of that truth is in the unfortunate case that occurs from time to time of the propagation of puerperal fever, where, although the person who attended the infectious case may go to the seaside for a month or more, the germs of the disease retain their vitality, and are conveyed to a second person. In such a case, what we have to teach is this: that nature's processes alone must not be relied upon, that it is not a question alone of time and exposure to those

benignant influences I have named—that these must be supplemented by active measures of personal disinfection and disinfection of clothing; and that such disinfection can only be carried out by the help of strong chemicals and by the use of appliances to which I will presently call attention.

Lastly, before concluding this part of the lecture in which I deal with methods of infection, I must not omit to mention especially the way in which very serious diseases are sometimes propagated by methods akin to that I have already spoken of as direct inoculation, with the hands and by the use of trade implements such as glass-blowers' pipes, &c. Against all these methods of infection the physicians and surgeons have to be constantly on their guard. It is by rightly understanding these methods of infection that you will be able to understand the *rationale* of disinfection. I have already said much on the subject of disinfection, what I have still to say will deal with questions of principle rather than those of detail. I have referred already to the benignant influences of nature's disinfectants, fresh air, sunlight, and cleanliness, but I have not referred to the influence of earth as a disinfectant partly because the exact nature of its influence is not fully understood. Although it is believed by some that it may be relied upon for the disinfection of such poisonous matter as the evacuations of typhoid fever, still for my part I would far rather see infectious matter of that kind dealt with by cremation.*

Artificial Disinfectants.—Of all the artificial disinfectants fire and heat (at boiling-point or over) are by far the most powerful. Heat, either moist or dry, answers admirably. Burning, as a method of disinfection, is not nearly so much resorted to as it might be. This is no doubt due to the practical difficulties which have not yet been surmounted. It is by no means an easy matter to burn infectious matter, nor is it easy to burn infected materials. I do not know whether you have ever tried to burn such a thing as a flock bed. If you have you will appreciate what I say. What is wanted at the present time is a good method of destroying infected matter by fire without causing any nuisance or any risk to the neighbourhood. The method of disinfection by heat now in use is that of steam; previously dry heat was usually resorted to. Dr. Ransom, of Nottingham, of whom I have already spoken, spent several years in perfecting a machine by which infected bedding and clothing could be exposed to heat of about 250° F. for several hours.

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* Outbreaks of scarlet fever sometimes occur when the soil is freshly turned up.

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The length of the time required for the process of disinfection was a practical drawback, and it has now been replaced by a system of disinfection by super-heated steam and disinfecting apparatus, of which you will see examples and models, have now been fixed in all our large towns, whilst portable machines on the same principle, adapted to the requirements of small villages and isolated districts, have been recently introduced.

Dr. Ransom's experiments were carried out to show the influence of heat on textile fabrics, with a view to the destruction of diseased germs, and it is now generally accepted that a heat of 250° F. is sufficient for all ordinary purposes. Bedding and clothing can be treated by the method of steaming, but linen, and all articles that can be so treated, should be boiled. It is not, however, always possible to boil linen before it is sent to the wash. For this purpose a solution of carbolic acid, the strength of which is laid down by some Sanitary Authorities, should be employed, and the linen soaked in it before it is sent away from the house. There are still many contents of the sick room that cannot be treated by either of these methods—either by steaming or by boiling. For these articles and materials, chemicals have to be resorted to.

I do not now propose to go into elaborate details. My desire is chiefly to give some special examples of the best methods of disinfection. An excellent list of antiseptics and disinfectants will be found in the Institute catalogue on pages 59 to 61, which I would advise you to study carefully. I would also, at the same time, advise you to examine with the same attention the specimens which are displayed in the Museum of the Institute. The disinfectants there enumerated are, fire, boiling water, and steam, hot dry air at 250° F. or thereabouts (employed for hours in order to secure penetration), and chemicals. Among the chemicals to be used the one that stands highest according to present knowledge is Perchloride of Mercury, to be used one part in one hundred, for an exposure of ten minutes, or one part in a thousand for an exposure of several hours. This material, perchloride of mercury, has enjoyed a very high reputation for some years on account of the observations made by no less a distinguished authority than Professor Koch, the great German discoverer and scientist; and so valuable is it believed to be, and so general are its uses, that the Local Government Board has issued a formula for the preparation of the disinfectant as a solution. It is a solution, I would say, that could even be relied upon for the disinfection of the infectious matter of cholera. It is as follows: $HgCl_2$ (perchloride of mercury), ℥ i, HCl (hydrochloric acid), ℥ ii, Water three gallons. Aniline blue a few grains to colour it,

and thymol to give it smell. This constitutes a solution of about one in five hundred. As the solution is highly poisonous the addition of colour and smell is very important to prevent serious accidents.

There is in the catalogue, as you will see, a very important note which bears upon the use of all disinfectants, chemical as well as others. In this connection, you will observe, that time is of great consideration. I mean, of course, *the time during which the material is exposed to the disinfectant.* For example, in the use of hot dry air, there is all the difference in the world between the exposure of bedding to the disinfecting influence for a short time, say half-an-hour, and its exposure for 4 or 6 hours. That remark applies equally to all chemicals, including that very powerful disinfectant, perchloride of mercury. You will have noticed that it is laid down in the catalogue that one part in 100 need only be used in the case of exposure of ten minutes, whereas one part in 1,000 requires to be in contact with the material to be disinfected for several hours. Here again I would desire to point out to you one very important matter to be considered, which, you will see, also appears on the note in the catalogue. It is this, that the re-agents must be added to the matter, to be disinfected in such quantity that they are present in the *whole weight of such matter at least to the extent shewn in the list.* That is to say, that if you are aiming at getting one part in 500 of perchloride applied to material containing the poison of cholera or typhoid fever, you must make certain that the solution you add is in such quantity and of such strength as to give you the proportion you require. In other words the disinfecting quantity must be in proportion to the bulk of the material to be dealt with, or you would find it so diluted as to become practically useless. I may here mention a useful thing to remember, viz., that one grain of the disinfecting medium in 2 ozs. of water, equals a strength of one part in a thousand. This solution of one part in a thousand of mercury perchloride could be used for many purposes; as for example, in the washing of a smooth surface which needed disinfection.

Carbolic acid is another very valuable disinfectant very generally used. This disinfectant again must be used in sufficient strength and for a sufficient length of time. In the catalogue it is laid down that it requires that as much as one part in twenty to the material to be disinfected should be exposed for twenty-four hours. Permanganate of potash is another disinfectant to which we have been accustomed for many years. This also requires to be used in the proportion of one in twenty with an exposure of twenty-four hours. Thus

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if you only consider what this one part in twenty signifies you will understand that many of the uses of carbolic acid and permanganate of potash as disinfectants come within the category of what a very famous medical writer has termed "vague or futile chemical libations." In fact, much of the so-called disinfection partakes of this character, as you may see any day by the sprinkling of the roads with powders and liquids which is so common and which can be of no practical use whatever.

The use of sulphur as a disinfectant is well known. There is, however, one point I would desire to emphasize. The fumes of burning sulphur are, as you know, sulphur dioxide ($S\,O_2$). In the presence of moisture (H_2O), they become the *active* disinfectant "*sulphurous acid*," which is not only the more familiar but the more accurate term for the disinfecting agent.* You will bear in mind, therefore, the necessity for taking care that the air of the "sealed room" about to be fumigated is well "steamed," *i.e.*, saturated with moisture, so that the walls or wall-papers become damp, while the sulphur is burning. Attention to this detail is essential for the purposes of efficient disinfection.

I would remind you of the importance of *quantity or strength* of a disinfectant and of *time exposure*. In the case of sulphur the quantity usually prescribed for disinfecting a room, is not less than 1 lb. for every 1,000 cubic feet of room space. In the case of chlorine it would seem, according to German experiments, that as much as 15 lbs. of chloride of lime and 22 lbs. of hydrochloric acid are required for every 1,000 cubic feet.

Whether sulphurous acid or chlorine be used the *time* during which the "as far as possible air-tight room" should be exposed to, or acted on, by the fumes, should not be less than eight hours.

In conclusion I will only again urge upon you the necessity of taking every precaution to secure immunity from contagion on every possible occasion. In small-pox, as I have pointed out, immunity might be secured by vaccination and re-vaccination. With this knowledge those who visited small-pox cases without adopting the obvious precautions would have no one to blame for possible and contingent results but themselves and their own carelessness. I am of course deeply interested in the antitoxin treatment for diphtheria, as a means of prevention as well as cure, but this is a subject which may well be held in reserve as the topic, perhaps of a future lecture.

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* See "Disinfction and Disinfectants," by S. Rideal, D.Sc.Lond. C. Griffin & Co.

SCAVENGING. DISPOSAL OF REFUSE.

By Charles Mason, Assoc.M.Inst.C.E.,

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(Member.)

Delivered November 22nd, 1895.

I purpose this evening giving you a few particulars as to the scavenging of streets and open spaces, as although the question of *House Refuse* is mainly referred to in the syllabus, no lecture upon scavenging can be considered complete without some reference to the cleansing of our streets.

The word "Scavenger" is, according to Dr. Johnson, derived from an old Saxon word signifying "to shave," or "sweep," and means a "petty magistrate whose province it is to keep the streets clean," or more commonly "the labourer employed in removing filth." It would thus appear that the word "Scavenging" in its strictest sense more properly applies to street cleansing, without reference to dustbins; but this can readily be understood, for in very early times dust receptacles were almost unknown, the street or public thoroughfare being the place into which all refuse was thrown. I purpose dividing my remarks into two heads: 1. Street Refuse, 2. House Refuse, the latter embracing Trade Refuse.

Street Refuse.

Street refuse is defined in the Public Health, London (1891) Act, as, "dust, dirt, rubbish, mud, road scrapings, ice, snow, and filth."

1. *Street Cleansing*—The method of paving streets is a very important factor as to the efficient cleansing thereof, the harder and more impervious the material the better.

Town Streets are now paved with either:

I. Asphalte.
II. Granite.
III. Wood, or
IV. Macadam.

Asphalte.—I have given these in the order of merit, asphalte

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undoubtedly being the best for cleansing purposes; this class of pavement is however liable in certain conditions of the weather to become greasy and slippery; it should on this account never be adopted on a steeper gradient than say 1 in 60.

Granite.—Granite pavements are very generally being supplanted with wood on account of the noise caused by the traffic thereon; they are, however, if properly laid and maintained well adapted for efficient scavenging.

Wood.—Wood pavements have been the subject of serious complaints on account of their absorption, and there is no doubt the opponents of this class of pavement have a strong case against wood when it is allowed to remain in a bad state of repair and consequently cannot be properly scavenged. The system of laying the blocks close together ensures a more even surface, consequently one better adapted for cleansing.

The *hard woods* now being introduced into this country afford a very good example of a pavement upon which a fairly good foothold for horses can always be secured, and when the blocks are evenly and truly cut, and laid close joined, a practically *impervious* pavement is obtained without the risk to horses that is so prejudicial to the use of asphalte.

The softer kinds of wood should always be thoroughly creosoted before being laid, as the creosote renders them less liable to take up moisture, and consequently impurities that are prejudicial to health.

Macadam.—Macadam in "built-up" areas is now being almost universally abolished, on account of the difficulty of keeping it free from dust in dry weather, the expense of maintenance, and difficulties in scavenging. In country and suburban districts however, it is still, and will no doubt for many years to come, be the favourite material for carriage-ways on account of its small initial cost.

All cab ranks should be paved with asphalte or other equally impervious material and properly drained.

Great care should be taken in seeing that pavements are well maintained; a good roadway is, as before stated, essential to successful scavenging, and it is impossible to have clean streets in wet weather if the surfaces are very much worn or out of repair.

The system of laying gas, water, and other pipes under the streets in any direction and position the Company owning such pipes may choose to determine, cannot be too strongly condemned, as in case of repair the street surface is in nine cases out of ten permanently injured, and the scavenger's work greatly increased. All pipes should be laid in properly constructed subways, a system now being adopted by the London County Council in their

new streets, and in vogue for some time past both in London and several provincial towns. I know of one town in which the surface of a granite paved street provided with a subway had not been disturbed for twenty-five years; what a boon it would be if we could say the same of our London streets!

Courts.—The surfaces of all courts and alleys should be paved with asphalte and regularly washed. Many of the courts in our large towns are paved with old flags with rough and uneven joints, in which all manner of filth is liable to accumulate, and render the atmosphere around the poorer dwellings extremely unhealthy.

Gulleys.—Street gulleys should be placed at regular intervals and where necessary, and should in all cases be properly trapped and with the exception of the outlet made perfectly watertight. They should be regularly emptied at stated times.

The old form of gulley in London consists of simply a straight brick shoot into the sewer, which forms a ventilator for sewer gas delivering directly on to the footpath, poisoning the air for passers by; this shoot in itself is also nothing more nor less than a generating "trunk" for foul gases, owing to the filth that necessarily accumulates on the brickwork between the gulley grating and the sewer.

A form of gulley very much adopted in London consists of two chambers, one of which acts as a catch pit for sludge, and is capable of holding about a cubic yard of detritus; this gulley or catch pit is very liable to be neglected and only cleaned out when the gulley is blocked, thus allowing the accumulated detritus to remain for weeks or months giving off harmful gases.

A good form of gulley is the stoneware trapped "coffee pot" gulley, which is easily cleaned out and does not allow of mud entering the sewers. An improved gulley known as the Crosta gulley has, however, recently been introduced in which a double trap is provided. This gulley is now being largely adopted in London and other towns, several having recently been fixed in the Strand, and it is there proved that nothing deleterious to the sewers can pass through the gulley.

Methods of Cleansing.—A well considered, carefully arranged system of scavenging is essential in order to ensure success; the district to be cleansed must be subdivided into workable areas, each having its gangs of men under the supervision of an inspector; the main streets of the parish must be cleansed first, and so on until the whole of the district is completed, and the system must be rigidly carried out as a matter of routine work, day by day, independently of the weather; if the weather be fine for several days and the streets do not want so much

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attention as in wet weather, no excuse should thereby be made for neglecting any portion of the work, or it will be found that the men become disorganized and the district will suffer. *Method, method, method,* should be the watchword of every superintendent of scavengers. I do not hesitate to say that those districts (of London) that have a regular routine system, which must not be departed from *under any excuse*, are the cleanest and best kept.

Various systems of street scavenging are employed in different towns, but the principle does not vary in any considerable extent.

In large towns the horse brooms generally commence work about midnight, when the streets are free from traffic; the men employed as hand sweepers commencing shortly after, who sweep into heaps the ridges on each side of the road that have been left by the machines, the carts or vans then follow at about 6 o'clock to pick up and take away the heaps.

Street "Orderlies."—The "orderly" system is generally employed for day work, and consists in providing lads or men at regular intervals in all the main thoroughfares and secondary streets.

Cast iron bins are sometimes placed upon the footways as receptacles for the sweepings of the "orderlies," and emptied periodically during the day by the scavengers' carts on their rounds.

These cast iron bins are often objected to by passers by, they are also liable to be used by adjoining occupiers as receptacles for their refuse. A better system is to provide the orderly men with specially made hand trucks to serve the same purpose as the bins: these trucks also assist in keeping the sweepers at work, as they cannot very well be left unattended on the roadway; they can readily be emptied into the vans as they pass.

Washing.—Washing the surfaces of paved roadways is now being adopted by several London parishes, and it is attended with great success.

A gang of men for the purpose consists of,—one turncock, one nozzle-man, and three or four sweepers.

The "nozzle-man" as his name implies attends to the hose and directs the water upon the roadways, the sweepers with squeegees following.

This form of scavenging is admirably adapted for cleansing all wood, granite, and asphalte pavements, and is the most sanitary method yet practiced. The main objection to the system is raised by the Authority who control the main sewers, and who naturally object to ballast being washed into the

sewers through the gulleys. Only a very small quantity of ballast for a foothold is however required, as the washing itself so thoroughly scours the pavements as to free them from all mud, which is the primary cause of slipperiness for the horses.

Moreover, if, as I always maintain, the County Council Authorities were to provide proper *trapped* gulleys, such as would not admit of any gravel or deleterious matter entering the sewers, and insist upon all Local Authorities doing the same, the cause of their grievance would be removed. The gravel, &c., of course, is very detrimental to the valves of the machinery at the several sewage pumping stations.

It must be distinctly borne in mind that I in no way encourage ballast and heavy articles being allowed to enter the sewers, but I do say this, that if gulleys are properly constructed it is impossible for ballast to pass into the sewers by fair means.

Washing the streets also serves to flush the sewers and keep them free from sludge and other deposits.

In the City of London, the late Colonel Haywood ascertained the cost of washing to be about 8½d. per yard. However, should the cost of *efficiently* cleaning our streets be a little in excess of carelessly doing the work it should not be objected to as the advantages to public health cannot be over-estimated.

Disposal.—In London the road sweepings are chiefly barged away and utilized in filling up waste land. In Manchester and many northern towns, a portion of the sweepings are sold as manure, or, as in the case of Liverpool, sent out to sea.

In the parish of Islington, the street refuse is washed in a mill, similar to an ordinary brickfield mill, about 20 feet in diameter, worked by a 12-h.p. engine. The washing costs about 8d. per load, the resultant (being mostly sand) is used for street paving and other purposes, the larger material being loaded into railway trucks with the other refuse.

Paris Streets.—The streets of Paris are mostly cleansed by washing—the larger and most frequented every day—the less important ones every other day, and the remainder twice a week. Washing by a hose attached to the street hydrants is adopted in the main streets and boulevards, the other streets being washed by water carts.

Snow Removal.—A lecture upon scavenging would be incomplete without some reference to the vexed question of snow removal, about which so much complaint is made.

If those who so readily rush into print and find fault with Local Authorities for not removing the snow as it falls were to remember *that for every inch of snow, about seven tons weight to every 1,200 super yards*, has to be removed; they would,

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I do not hesitate to say, change their abuse into praise, for those who have to deal with such an enormous task.

There exist practically two systems for the removal of snow, viz.:—

I. By sweeping and carting away.

II. By sprinkling salt and washing the resultant liquid off the roads.

Clean snow can be tipped into the river or sewers: it is, however, seldom that the latter course is adopted, as only the main sewers have sufficient volume and velocity to take away the snow as quickly as it is deposited in the manholes.

The use of salt is often a necessary evil, and should only be resorted to when circumstances render it almost impossible to deal with snow by carting. Salt, when mixed with snow produces a freezing mixture, generating a peculiar chilliness dangerous to health, so that the use of salt should be confined to night work, if possible, and the resultant immediately washed away.

Now that the footways within the Metropolitan area have to be cleansed by the Local Authorities, additional work has been necessitated, and increased responsibility devolves upon the officials, for if the snow be not removed from the footways *immediately*, it becomes trampled upon the pavement, and has then to be carefully scraped off at great expense in labour. Under the old system householders were responsible for cleansing the footway opposite their own premises.

When sweeping is resorted to, the men should be turned out immediately upon the cessation of the snowfall and commence clearing the footpaths by pushing the snow therefrom into the roadway, taking care to leave the channels perfectly free to allow, in case of a thaw, the water to run freely away. The men in the roadway should follow by clearing the road right and left, thus leaving a ridge of snow each side through which passages should be made at regular intervals in order to allow water to pass to the channels in case of thaw, carts can then follow to pick up the accumulated snow. Everything in connection with a fall of snow requires a *perfect* system in management with all in readiness for use at a moment's notice.

The following particulars of the snowfall in *1881* which reached a depth of six to seven inches will be of interest as showing what an enormous amount of work is entailed in the removal of snow.

The figures are from the statistics by the late Engineer to the City Corporation.

The removal of this fall of snow from the City necessitated the employment of 1287 hands and 288 horses and carts, the

number varying slightly day by day. The work of clearance continued day and night by relays of men and horses and continued for a whole week, during which time no less than 70,445 cubic yards of snow were removed, estimated to represent a *quarter of a million* cubic yards measured as it lay after the fall. The additional cost of this work over and above wages of regular staff was £4,254.

Street Watering.—Street watering is a necessity in the summer months as a means of keeping down the dust which accumulates in greater or less degree upon all classes of pavement. Were it not for a system of street watering the atmosphere in large towns would be almost unbearable in dry weather; watering the streets besides keeping down the dust renders the atmosphere cool and refreshing and also assists in maintaining a good pavement.

A judicious arrangement of standposts for filling the vans is necessary in order to avoid too much time being wasted in going to and from the work.

Vans will do their work far more economically than carts, as the carts waste more time in travelling to and from the standpost. It has been found from experiment that a van will spread a width of 20 feet as against 14 for a cart. The van in emptying travelling almost double the distance done by the cart, a total saving of from 26 to 30 per cent. is effected thereby, although carts are better adapted for watering steep gradients.

About one-fifth of a gallon is used per super yard with the ordinary water-cart spreader.

In very hot weather disinfectants are sometimes mixed with the water; in my own district a mixture of manganate of soda, sulphuric acid and water is used in the following proportions: manganate of soda 1 lb; sulphuric acid ½ pint; water 1 gallon, to 100 gallons of water in the van. It is found to give a feeling of greater freshness to the atmosphere.

If the streets are properly scavenged in the night or early morning it is sufficient to water the sides of the carriage-ways only, especially is such the case on asphalte roads as the watering tends to make the surface slippery. The wet channels also readily catch any particles of dust blown along from the centre of the road.

In many seaside towns salt water is used for street watering purposes, which is in itself far more effective than fresh water, as lasting for a much longer time, one load of sea water being equal to three loads of fresh. Some objection has been raised on account of sea water being detrimental to the road surfaces, but I have not heard of such objections being founded on facts,

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and myself think they are groundless. The fact of sea water lasting three times as long as fresh water is a strong argument in its favour.

PART II.

House Refuse and Trade Refuse.

Definition.—House refuse is defined as "ashes, cinders, breeze, rubbish, nightsoil, and filth."

Under the provisions of the Public Health Acts, Sanitary Authorities are legally compelled "to (themselves) undertake "(or contract for) the removal of house refuse, and the "cleansing of closets, privies, ashpits and cesspools"—very full power being given them for providing for the proper and efficient collection and removal of such refuse.

The Sanitary Authorities, however, are not allowed to neglect their duties, as by Section 30 of the Public Health (London) Act, 1891, it is provided that "where the house refuse is not "removed from any premises . . . . and the occupier of "the premises serves on the authority a written notice requiring "the removal of such refuse . . . . within forty-eight "hours after service, and the authority fail without reasonable "cause to comply therewith, they shall be liable to a fine not "exceeding twenty pounds."

You will thus see how important it is to have as perfect a system as possible for a periodical and regular collection of all kinds of refuse.

The quantity of house refuse in London is approximately 1,250,000 tons per annum, or about 4 cwt. per head.

These figures are from statistics collected by the London County Council for the purpose of preparing a report upon "Dust Destruction"—statistics, however, should be accepted with caution, as I find in analysing the above, the amount per head varies from 1·7 cwt. in Bermondsey to 14· cwt. in St. Luke's. From my own experience and past statistics, I am of opinion that 4 cwt. per head is a fair average for London, but in estimating generally throughout the Country, from 7 cwt. to 10 cwt. per head should be allowed for. Everything tends to prove what a variable quantity house refuse is, and due consideration should be given to the class of house and number and nature of business establishments in the district.

House Refuse—Dust Bins.

Dust Bins.—Everything in the shape of a *fixed* receptacle for

dust and house refuse should be abolished, and unless under very special circumstances, fixed or built-up places should never be allowed in a town. Dust "shoots" should also never be countenanced in a building.

Model.—Portable galvanized iron bins provided with a cover, should be insisted on in every case, the size being about 15 in. diameter by 18 in. deep; should the quantity of refuse from any given place demand it, duplicate receptacles should be provided. In order to prevent them being used for liquids, perforations should be made in each side near the bottom; a good plan is to write the initials of the owner by these perforations.

L.C.C. By-laws.—The London County Council's by-laws, approved by the Local Government Board, provide for "one or "more movable receptacles sufficient to contain the house refuse "for a period not exceeding one week"—and further specify that the receptacles "shall be of metal provided with a cover, "the capacity of each not to exceed two cubic feet."

These by-laws (under Section 39 of the Public Health Act (London) 1891, are in themselves a study of what is now universally acknowledged to be the best sanitation of the day. Exception should, however, be taken to the clauses relating to "*privies*" and "*cesspools*," as these receptacles should not be even conditionally sanctioned in the Meropolitan area.

Collection.—It will thus be seen that receptacles for house refuse should never be made of an unwieldly size, and always portable. It may be difficult in outlying places, but in thickly populated districts no excuse should be made for storing refuse for more than five or six days at the longest.

A *daily system* of collection should be adopted universally, but difficulties continually arise from the fact of the dust bin being in an inaccessible place, and the unwillingness of many householders to let the dustmen enter when they call. Perfection in dust collection is like everything else, easier to arrange than to carry out. The system of placing dust receptacles on the street curb is a good one; here again the desirability of having a proper covered bin is patent to anyone.

In suburban districts the system of placing a letter D. in the window is to be encouraged, as saving time where long rounds have to be made.

Four-wheeled vans having a capacity of from two to four cubic yards, are the most common form of carriage for removing refuse and answer the purpose very well, they should, however, be fitted with proper covers, otherwise they become a nuisance in transit, owing to loose paper, &c., being littered on the streets, as unfortunately is often the case.

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Excreta—Storage.

Receptacles.—The earliest form of receptacle for excreta consisted of the old-fashioned privy, the receiver of which was simply a hole or vault in the ground lined with brickwork and made sufficiently large to require emptying only at intervals of six months or more.

Cesspits and Cesspools were the receptacles for slop and waste waters, also for the drainage of W.C.'s, generally built in brickwork, arched over and provided with a cover of stone or wood; provision was usually made for an overflow therefrom into the nearest water course, consequently the cleansing of such places was done at long intervals of time.

It will thus be seen that the principal object in olden times was to make all receptacles for refuse, as large as possible, and so arranged as to necessitate cleaning at the longest possible intervals.

As you well know modern sanitation is arranged on a basis exactly opposite to this, and we now provide for the removal of all kinds of refuse as frequently as possible.

The next step was the introduction of a combined form of privy and ashpit, in which the closet seat was placed partly over a vault of brickwork, into which the ashes and other house refuse were thrown, the idea being that the ashes and night-soil in combination would reduce the emanations from the latter to a minimum.

This system is now in use in many country districts, but like its predecessors is not to be recommended, although a decided advance on the old privy.

Pail Closets followed, and their introduction has been very successful in the smaller and scattered districts.

The size of one of these closets should be about 5 ft. by 3 ft. built in brickwork, having a hinged seat and riser; the pail should measure about 18 inches across by 15 inches deep (half a disused paraffin cask makes a very good pail).

One pail is sufficient for a small house, the ashes and dry refuse going into it, and emptied by the local scavengers once a week, or more frequently if desired. To facilitate the collection of the pails, the seat front or riser is made moveable, so that the pail may be withdrawn, or if practicable a door is constructed in the back wall of the building through which the pail can be taken. Clean pails are exchanged for the full ones, the full pails being removed in special vans to the depôt for transporting their contents to the country as manure. The pails after being emptied at the depôt, should be thoroughly cleansed, disinfected, and stored for re-usage.

Excreta.—The collection and disposal of human excreta is generally classed under two heads:

(I.) The water-carriage system.

(II.) The conservancy system.

The water-carriage system does not come within the scope of this lecture, and has no doubt been dealt with by other lecturers on "Sewage Disposal" and "House Drainage."

It is only necessary for me to refer as a matter of history to one fact in connection with the early method of constructing w.c.'s and the drainage therefrom, in order to shew how reluctantly the old-fashioned cesspool was given up.

It was thought very unwise to allow the contents of w.c.'s to enter the sewers direct, consequently a cesspool was invariably constructed or an old one retained to act as a sort of settling tank for the solids, an overflow therefrom being connected to the sewer. It is hardly necessary for me to point out to you the objection to this system, it was neither more nor less than increasing the evils of the old cesspits, as before they were (of necessity) emptied when full, but where an overflow to the sewers was provided no visible reason existed for cleaning them, consequently they were never attended to, and were in scores of cases forgotten altogether, remaining as the embodiment of all that was vile and unhealthy. Some of these abominations may possibly remain to the present day, the inmates of adjoining houses being in blissful ignorance of their existence.

Only within the last twelve months one of them was discovered in Buckingham Street, Strand; in this case the house drains had been disconnected so that no direct communication existed, the cesspit was directly in the line of a new sewer and the stench liberated by the excavator can be better imagined than described.

Sewers and drains are of course essential in large towns for dealing with the wastes from slop sinks, baths, &c.

Slop Closets.—Several ideas have been conceived for utilizing house waste water for the purpose of flushing closets, the arrangement being known as the "Slop water closet," which is adapted for houses of the poorer classes, there being no fittings to get out of order as in the case of w.c.'s. A good form of ordinary w.c. is however preferable, as the waste slop water tends to render the collecting receptacles offensive. Slop water closets should never be introduced unless there be a frequent and regular supervision on the part of the sanitary officer.

Conservancy System.—The Conservancy System embraces the removal and disposal of excreta by dry methods, with a view to its being manufactured into manure or otherwise made a source of profit.

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This system is better adapted for rural places, than for the more populous districts, owing to the difficulty and inconvenience of collection and removal in large towns.

It is also found unsuitable for towns having a greater population than about 40,000, on account of the amount of refuse being greater than the demand of the surrounding agricultural land.

On this account, Nottingham, Manchester, Bradford, and other large towns, are gradually lessening the number of their pail closets in favour of a general system of water closets.

At the same time the pail system answers very well for small towns and villages, as effectually doing away with the old fashioned midden, and providing a means of utilizing in a profitable manner all solid domestic refuse.

Rochdale is looked upon as the pioneer town for the pail system, the whole being well organised by Mr. Platt, the Borough Engineer, to whom I am indebted for the following particulars.

Pails are used for excreta only, the contents being treated as follows:—

The pails are on removal from the vans emptied into tanks; the excreta in the tanks being mixed with sulphuric acid in the proportion of 24 lbs. of acid to the ton (to fix the ammonia).

It is then run into revolving cylinders, about 6 feet diameter through which all the smoke and hot air from specially constructed furnaces passes. The revolutions of the cylinders agitate the excreta, thus exposing fresh surfaces to the hot air.

The charge of a cylinder is 3½ tons, which in 12 hours is reduced to nearly 5½ cwts. of a material very like hard clay, which is dried on hot plates. The manure, when dried to 10 or 12 per cent. of moisture, is ground in a pug mill and sold in sacks at about £6 per ton as a valuable manure.

The conclusions to be arrived at, as to the relative merits of the water carriage system, and the conservency system are, that the water carriage system undoubtedly ensures greater health and cleanliness where people are congregated as in large towns, and should generally be adopted. Should the exigencies of any particular place not be favourable to the adoption of water carriage the pail system takes second place, but it should be borne in mind that the greatest care must be taken in order to ensure all slops and water being kept out of the pails, as where complaint is made of any offensiveness it is invariably due to the presence of an excess of moisture in the pail.

I will now confine my remarks to one of the vital questions of the day, viz., what to do with our house refuse?

REFUSE DISPOSAL.

The system of carting all refuse to the nearest waste ground or filling up disused brick yards in the neighbourhood of towns, should be condemned as being directly opposed to all ideas of modern sanitation. It is to be regretted, however, that many towns still carry on this rough and ready way of getting rid of their refuse.

The health of a community depends chiefly upon the purity of its air, soil, and water supply. I know a large town where the summer death-rate from infantile diarrhœa for several successive years for children under one year of age was as high as 209 per 1,000. The cause could not be satisfactorily explained, so a Local Government Board Inquiry was instituted extending over several years.

It was found that the disease was most virulent in June, July and August, and it was practically proved that the high infantile death-rate was due in a great measure to the enormous number of old brickfields surrounding the town that had, from time to time, been filled up with town's refuse.

The Government Inspector in his report stated that, "from "the contained organic matter of particular soils, micro-organ- "isms are generated capable of manufacturing in the soil by "chemical changes (through certain of their life processes) a "substance which is a virulent chemical poison, which poison in "the human body is the material cause of epidemic diarrhœa."

The Medical Officer of Health reported that, "in those districts where diarrhœa most prevails, the atmosphere is contaminated with enormous numbers of microbes and their germs. That these latter are in all probability the prime factor in the causation of the disease."

I mention this (although I do not suppose you require much convincing), to prove to you how dangerous is the system of allowing refuse shoots upon areas likely to be built upon.

The Annual Report of the Local Government Board for 1891-92 containing the medical officer's reports as to nuisances arising from shooting refuse on waste lands contains valuable information in relation to this matter.

Dust Destructors.—Disposal of refuse by cremation has for some considerable time occupied the attention of Sanitary Authorities, and the system of erecting refuse destructors is now being adopted by a great many municipalities.

A destructor consists of a group of furnaces or cells each about 9 ft. × 5 ft. × 3 ft. 6 in. in height to the soffit of the fire-brick arch. The furnace bars have an inclination of about 1 in 3 from back to front, behind which, and at the same inclination, is a fire-brick hearth, behind the hearth a wall divides the flue

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from the refuse feeding place, the cell-flue going downwards into the main flue and the feeding place sloping up to the opening for admission of refuse. Over some of the furnaces is placed a second and larger opening directly over the hottest part of the fire for admission of mattresses, condemned meat, &c. The furnace doors are hung on hinges to open outwards and worked with balance weights. The whole structure is tied together with iron rods and stays, the cells being usually arranged in pairs and built back to back. A group of four cells measures about 14 ft. × 24 ft., and a group of six, 21 ft. × 24 ft. the height being about 12 ft. An inclined roadway is generally constructed in connection with the cells so that the refuse carts may tip directly on the platform close to the feeding doors.

The feed openings are kept filled with refuse which keeps sliding forward on the sloping hearth, and is partially dried by the heat given out by the fire below and reverberated by the furnace arch; a hard clinker is left, which is raked out at given intervals through the furnace doors.

The hot gases are generally utilized by being carried through a multitubular boiler to produce steam necessary for working any machinery in connection with the apparatus, or for any other purpose.

A cell, having a fire-grate area of 25 square feet, will burn from 30 to 35 tons of refuse per week, the residue in clinker being about 25 to 30 per cent.

Mr. Alfred Fryer was one of the first to patent a destructor dealing with large quantities of refuse. This destructor has been working in many of our large towns for several years, there being several in London and suburbs. At Leicester a Fryer's Destructor has been erected immediately adjoining a large Board School, the chimney being within thirty feet of the class-rooms, and the tipping platform within fifty feet of a residential street, and I am informed no complaint has been made of its being in any way a nuisance. The site is naturally a good one, the level of the street being about 15 feet above the clinkering level, thus saving the necessity of an inclined roadway. Complaints have been recorded in some places as to unburnt paper, dust, and other articles escaping from the top of the shaft. Mr. Charles Jones, of Ealing, devised to remedy this, a "fume cremator" which has been fixed in many of Fryer's Destructors between the furnaces and chimney shaft, this cremator is fed by fine coke breeze from above, and has been successful in preventing the escape of unburnt articles from the shaft—from 1,500 to 1,800 degrees Fahr. of heat being generally maintained.

Horsfall's Destructor erected at Oldham, Leeds, and else-

where, has the flues arranged in such a manner that the outlets for the products of combustion are in front and over the hottest part of the fire, so that all the fumes given off by the refuse in drying have to pass through the hottest part of the furnace before they can escape to the chimney, and are thus "cremated" within the furnace itself, no extraneous fuel being required.

Steam jets for forcing the draught are used in connection with a closed ash-pit, maintaining a temperature of more than 1500° F. in the furnace. The steam after passing through the blast pipe enters the steam boxes placed one on each side of the furnace, and leaves through a number of small holes placed under the grate bars, thus producing an even spray of blast, and at the same time, by the continual current of cool air passing through the boxes, protecting the sides of the furnace from the destructive action of adhering clinkers.

The patentee claims that by reason of the forced draught, a tall chimney shaft is not required.

The dust carts tip directly into a large hopper at the back of each furnace, the bottom of which is formed of movable steps or slides which automatically carry the refuse forward into the furnace. The grate surface is formed of movable bars which are worked by steam in the same way as the movable slides, and which break up the clinker and move it forward in the furnace on to a wide "dead plate," from which it is raked into a barrow.

In a report prepared by the Engineer and Medical Officer to the London County Council this destructor was thus referred to: "There can be no doubt that in furnaces of this type the "decomposition of organic and combustible matter is so perfect "that no nuisance is likely to arise from its use."

Warner's destructor, patented by Mr. Wm. Warner of the firm of Goddard, Massey & Warner, of Nottingham, is similar in general arrangement to Fryer's Destructor, the main difference being in the clinkering doors, outlets from cells to main flue, and the mode of charging the furnaces. Destructors of this pattern have been erected at Hornsey, Bournemouth, and Newcastle-on-Tyne.

The introduction of mechanical furnace bars has done much to assist combustion by preventing the clinker adhering to the bars; the amount of fine ash is, however, considerably increased by these bars, which are generally arranged to work in a rocking manner, each alternate bar being fixed.

In urging the advantages of cremation, the general reply we receive is as to the wholesale waste of materials, which if properly sorted can be turned into articles of value. My answer to this objection is, that the heat produced in a destructor is more

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valuable if properly utilized than any return from sortings of refuse. The destructor system is, in my opinion, by far the most economical, sanitary, and scientific way of getting rid of refuse, and the time will come when all towns will adopt some form of destructor; the system of sorting refuse being a disgrace to any authority adopting it.

If destructors are carefully arranged and properly managed they are not a nuisance, as is proved by those at Leicester, Ealing, and elsewhere.

The Medical Officer and Engineer to the London County Council in the report referred to, mention the following points as demanding special attention in destructors: 1, "temperature "obtained should be sufficiently high; 2, the duration of exposure "to a high temperature should be sufficiently long; 3, *all* the "vapours escaping from the refuse should be heated to a suffi-"cient extent, and there should be no possibility of the escape "of any un-decomposed vapours into the chimney shaft." These points tend to show that a perfect destructor should produce a regular and powerful heat, *but it is yet an unsolved problem how best to construct a furnace that shall give perfect combustion, and at the same time utilize the whole of the heat generated for producing steam.* It is found that steam jets are the best means for obtaining high temperatures, but these jets in themselves take away a considerable quantity of steam that might be used for producing power; from experiments made at Oldham with a Horsfall Destructor it was found that about seven-sixteenths of the total steam available was used in the steam blast. Again in order to obtain the best steam-producing results, the boiler should be immediately above the furnace, but this would impede combustion by interfering with the arrangement of the flues by presenting a large cooling surface of the boiler to the fire. Boilers for generating steam are generally placed upon the main flue between the cells and chimney shaft.

One of Fryer's destructors has, however, been very recently constructed at Cambridge, in which the boilers have been arranged *between* the cells in close proximity to the fire. The trial results have been very successful, and there is every reason to believe that this arrangement is the most satisfactory yet introduced for the generation of steam from refuse; we must, however, always bear in mind when looking for results in producing steam, that a destructor is primarily for the purpose of destroying refuse and noxious articles, and the production of steam must be a secondary consideration.

The waste heat from the Ealing Destructor is utilised for electric light production, and the St. Pancras Vestry have adopted a similar process. There is little doubt that with a

general adoption of destructors for towns' refuse, the whole machinery connected with the public management might be worked therefrom, provided the refuse were supplemented with small quantities of coal when occasion require.

TRADE REFUSE.

Trade Refuse is defined as "the refuse of any trade, manufacture or business, or of any building material," and is a subject upon which a great deal of contention has arisen; the best thing appears to be for each district to form its own decision, based upon local circumstances, as to whether trade refuse should be taken by the local authority at a special charge, or whether it should be treated as house refuse and removed free of charge.

For instance, it is manifestly unfair in a suburban district for the Authorities to take away garden and similar large accumulations of refuse without making some extra charge, and in a built-up neighbourhood which is heavily rated, it appears equally unfair to charge, say, a restaurant proprietor, for removing his refuse as "trade," when similar refuse from an hotel is treated as house refuse. I mention these as instances to show how difficult it is to treat all districts alike.

The method of disposing of trade refuse is generally the same as already referred to for house refuse.

Manufacturers' Sewage.—It has been the custom to look upon bleach, dye, and other similar waste waters, sometimes called "Manufacturers' Sewage" as being comparatively harmless, and they have consequently been allowed to foul the streams and rivers generally throughout the country in the districts where such trades occur.

Little has up to the present time been done to prevent these waste waters polluting our smaller streams and rivers, and it is high time for something to be done to compel a discontinuance of the practice. Anyone who has once visited a manufacturing district, cannot but be grieved by such wholesale pollution of what otherwise would be beautifully clear streams.

The remedy for this should be a compulsory system, whereby each manufacturer provides settling tanks or other means of purifying the waste before it enters the stream; or the Sanitary Authority should take the whole into a separate system of sewers, to be dealt with independently of the ordinary town sewage. This class of waste has practically no manurial value, and the volume is generally very great, in fact often equal to that of the ordinary town sewage, so that it would be prejudicial to admit it on any farm in large quantities, moreover

the chloride of lime forming a powerful precipitant would, where flat gradients exist, have a tendency to block the main sewers.

Conclusion.

In conclusion, I trust I have drawn your attention to the importance of the Refuse Disposal question, which is a very large one, and one in which great strides have been made, yet without perfection having been attained; at the same time, each town or district generally has facilities or a peculiarity of its own, due to natural causes, that prevent a universal system being adopted.

REVIEWS OF BOOKS.

RURAL WATER SUPPLY.*

This is a very useful little work, compiled from articles which appeared in "The Builder" during the latter part of the year 1894, revised and brought up to date, and will be found to be of considerable interest to the public generally as well as to those for whom it seems to be primarily intended.

A very concise preface by Mr. G. C. Greenwell, as well as one by the Authors indicates clearly the object to be attained.

The Authors do not claim to introduce any original matter, but they have undoubtedly led the way to a rudimentary study of Hydraulic Engineering, and have indicated the sources from which they have drawn largely for their facts, also dispelled much of the needless mystery which too often pervades works on scientific subjects.

A superficial knowledge of a subject, especially such as Rural Water Supply, is to be deplored; it is hoped therefore that those who read the work, which all may do with advantage, will look upon their action merely as a step upon "the lower rung of the ladder"—to quote Mr. Greenwell's expression—and will "drink deep" of a science, the importance of which in the present day cannot be over-estimated.

The Authors deal with the matter in a more elementary way than is to be found in the extended works to which they refer and they have attained the object they had in view, the work nevertheless contains formulæ, tables, &c., which are valuable for reference.

They clearly point out the course to be adopted when it has been decided to carry forward a scheme for supplying a district with water, they indicate the principles in valuation of land, rights of property, and following up with engineering, surveying, and levelling, selection of materials, various methods of pumping—a subject which is dealt with in much detail—measurement of rainfall, the use of the rain gauge, gauging of streams, flow of water in pipes, sources of water and its pollution, well sinking and boring, and the preparation of plans, sections, and estimates.

Several chapters are devoted to storage of water and to filtration, the distribution of water, and house connections and fittings; the work closes with details of procedure at public enquiries.

The language used throughout is plain and intelligible, so that "he may run that readeth it," the numerous diagrams are clear and well executed.

The book can be confidently recommended as a reliable guide to beginners and a valuable addition to our elementary works on Water Supply. L. F.

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* Rural Water Supply by Allan Greenwell, Assoc.M.Inst.C.E., and W. T. Curry, Assoc.M.Inst.C.E., F.G.S. Crown 8vo., 210 pp. Crosby Lockwood & Co. London, 1895.

A HANDBOOK OF HYGIENE.*

"The writer first felt the need of some such handbook when serving abroad, and unable to carry about more than a very minimum amount of books," and he has well digested his information into a portable compass. The consideration of the Departments of Special Hygiene and of Public Health is stated not to be entered into, except incidentally. Notwithstanding these modest limitations, this book contains an immense amount of matter well compiled, the result of wide reading and numerous references. It contains many useful formulæ and tables, and is of a convenient pocket size—albeit the small and compact type is somewhat trying to the eyes.

The impression cannot be resisted, in reading the book, that many readers in this country would have been grateful to the author if he had expanded it into a larger work and amplified certain sections. For instance, the disinfection of clothing and bedding, only occupies two pages, and the disposal of town refuse, only occupies a page and a quarter. The amount of space devoted to the various subjects is differently proportioned: whereas food and dieting are expanded to 136 pages (or nearly a quarter of the volume), statistics are compressed into six pages.

As before said, considering the size of the book, the amount of information is immense, and it is clearly and succinctly stated.

It is fairly up to date, but to this one or two exceptions must be made. The old details as to the construction and materials of filters which have of late been proved worthless are fully set out, and it is stated that one of the first conditions is to arrest micro-organisms, and that this condition is fulfilled more or less by all the filtering media mentioned. It is also considered that domestic filtration is advisable for a large proportion of the water provided by the London companies. Disinfection by steam might have been more insisted upon, and more elaborated. In the conclusions as to sewage disposal no mention is made of the fact that precipitation combined with filtration or irrigation is often to be recommended.

However, these are lesser points compared to the general value of the work as a whole. This handbook will be valued by those who require in a condensed form a portable compendium during practical work.

J. F. J. S.

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* By A. M. Davies, Surgeon-Major, A.M.S. 8vo., 590 pp. London, 1895. Charles Griffin & Co., Ltd.

NOTES ON BOOKS AND PAPERS IN TRANSACTIONS.

"Building Construction" (Advanced and Honours Courses). By CHAS. F. MITCHELL, assisted by GEO. A. MITCHELL. 506 pp., 8vo. *B. T. Batsford. London*, 1894. *Price* 5/6.

In addition to the Examinations of the Science and Art Department, this volume is intended to assist students for the Examinations of the Royal Institute of British Architects, the Surveyors' Institution, the City Guilds, Civil Service, and other Examinations.

Being intended for the advanced courses, the principles and details of modern construction are specially dealt with, as will be seen by the following headings of chapters: Materials, Foundations, Brickwork, Masonry, Carpentry, Fire Resisting Construction, Staircasing, Sanitation, Hot Water Supply, and Ventilation.

Copies of past questions for the Advanced and Honours Course of Building Construction are given in the Appendix.

"Building Construction and Drawing." First stage or Elementary course, third edition revised and enlarged, by CHARLES F. MITCHELL. 272 pp., 8vo. *B. T. Batsford. London*, 1894. *Price 3/-*

The Volume is intended as a text book for students preparing for the Examinations of the Science and Art Department in Elementary Building Construction. There are upwards of 550 illustrations.

The subjects dealt with are Brickwork, Masonry, Girders, Joints in Carpentry, Floors, Partitions, Roofs, Joinery, Plumbing, and Slating.

The Science and Art Departments' syllabus and copies of past examination Questions are also given.

"Public Health." Catechism Series, in five parts. 8vo. *E. & S. Livingstone, Edinburgh. Price 1/- each.*

These pamphlets, consisting of between 50 and 60 pages, are arranged in the form of questions and answers, and are intended to aid a student in preparing his work for examinations. Part I. deals with Water; Part II., Air and Ventilation; Part III., Sewage; Part IV. Vital Statistics; and Part V., Medicine, Food, Burial, Water Closets, Disinfectants, Warming and Hospitals.

"Sewerage and Sewage Disposal of a Small Town," by E. B. SAVAGE, Assoc.M.Inst.C.E. 78 pp. (plans), 8vo. *Biggs & Co. London*, 1895. *Price 5/-*

The author here describes through their various stages the methods and plan to be adopted in designing a scheme of Sewerage and Sewage Disposal, and to do this the author has given an example of a small

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town explaining the investigations necessary, in order to decide upon the method to be adopted for the Disposal of the Sewage. As the author states, he does not deal with the principles which form the basis of Sanitary Engineering, but describes in as simple a manner as possible the practical application of the principles advocated. The book is primarily intended for the assistance of young Engineers, or those who perhaps for the first time are called upon to design a scheme of Sewerage and Sewage Disposal.

"Penological and Preventive Principles, with special reference to Europe and America," by WILLIAM TALLACK, Secretary of the Howard Association, London. 2nd Edition. 480 pp., 8vo. *Wertheimer, Lea & Co. London*, 1896. *Price 8/-*

This book is intended to relate more to present and prospective conditions and to principles of permanent validity, than to history and conditions now out of date.

The book is chiefly designed to assist those engaged in efforts to diminish Crime, Vice, and Pauperism.

There are twenty-four Chapters, and the following are among the subjects dealt with:—Prisons, Intemperance, Prostitution, Education, Criminal Statistics. The last two Chapters are devoted to John Howard, describing the principles which actuated his life work.

In the form of an Appendix is a résumé of the International Prison Congress at Paris, 1895.

"Elementary Physics and Chemistry,"

In the Examination recently established by The Sanitary Institute in Practical Sanitary Science, Chemistry and Physics are included in the syllabus; and to meet the numerous requests for standard works on these subjects the following have been presented to the Library by the publishers.

"Chemistry" (Catechism Series). Part I., Inorganic; Part II., Inorganic and Organic. *Price 1/- each.*

FISHER, W. W. "Elementary Chemistry." *Price 4/6.*

GREVILLE, H. LEICESTER. "Handbook of Chemistry." *Price 6/-*

JAGO, WILLIAM. "Inorganic Chemistry, Theoretical and Practical." *Price 2/6.*

ROSCOE, Sir HENRY E. "Elementary Chemistry." *Price 4/6.*

ROSCOE, Sir HENRY E. "Inorganic Chemistry for Beginners." *Price 2/6.*

STEWART, Prof. BALFOUR. "Elementary Physics." *Price 4/6.*

WRIGHT, Prof. MARK R. "Elementary Physics." *Price 2/6.*

WOOLCOMBE, W. G. "Practical Work in General Physics." *Price 3/-*

The full titles are given in the list of Presentations to the Library, p 527.

"The Institution of Civil Engineers." Vol. CXXII. 1894-5. Part IV.

In this Volume, among "Other Selected Papers," there is a paper on:

"A new Formula for the flow in Sewers and Water Mains," by W. SANTO CRIMP and C. E. BRUGES.

Among "Abstracts of Papers in Foreign Transactions and Periodicals" are the following:—

"The Purification of the Seine by the Distribution of the Sewage Waters over the Plains of Achéres." (La Revue Technique, July 25th, 1895).

"Some processes for the Purification and Sterilization of Potable Waters, by GEORGES MICHEL. (Bulletin de la Société Scientifique Industrièlle, 1894).

"Destructor Furnace Experiments in Berlin." (Gesundheits Ingenieur, July, 1895).

"The Heating and Ventilating of the New Reichstag Building in Berlin." (Zeitschrift des Allegemeinen Vereines, 1895).

"The Institution of Civil Engineers." Subject Index to the Minutes of Proceedings. Vols. LIX. to CXVIII. Sessions 1879-80 to 1893-94. 533 pp. 8vo. *London*, 1895.

To the Sanitary Engineer searching for Papers and Discussions on Waterworks, Water Supply of Cities and Towns, Drainage and Sewage Disposal, &c., this Index would be found very useful.

"Institute of Engineers and Shipbuilders in Scotland." Vol. XXXVIII. 1894—95.

The paper in this Volume of most interest, from a sanitary standpoint, is that by JAMES M. GALE, M.Inst.C.E., on "Extension of Loch Katrine Waterworks."

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"ON PUTRID GASES AS PREDISPOSING CAUSES OF TYPHOID INFECTION."*

It is an old opinion that infectious diseases can be generated from putrid exhalations.

Not long before our time Murchison had tried to demonstrate this thesis by typhoid fever, referring its cause especially to sewer gases, which sometimes penetrate into habitations. In fact, he had observed that epidemics of typhoid became excessive principally where the conditions of the surrounding inhabitants were the worst, through the bad construction of closets. It was in this precisely that the "pythogenic theory"[1] consisted, in which it was endeavoured to affirm the spontaneous and self-produced generation of typhoid fever.

But this theory was harshly criticised by Budd,[2] who, admitting the facts observed by Murchison, could not agree to the spontaneous generation of the disease, maintaining that putrid substances were capable of generating typhoid, only in the presence of a specific contagion.

The field of discussion was then divided between these two opinions. The supporters of Murchison's theory insisted on the fact frequently observed of typhoid fevers having been caused by ingestion of corrupt substances, and quoted several instances, among others the epidemic of Andelfingen in the Canton of Zurich in 1838.[3] Liebermeister then maintained that not only abdominal typhoid, but also a long series of specific maladies, of origin then unknown, might arise from the decomposition of organic substances, as for example the plague, dysentery, malaria, yellow fever, exanthemic typhoid, and cholera. But he added, that to explain the origin of abdominal typhoid it was not enough to have recourse to the sole theory of any decomposition or putrefaction of organic substances whatever, but it was necessary that this decomposition should be of a specific and particular character, and should give as its special product the virus of the abdominal typhoid.

Against the "sewer gases theory" have been brought forward other facts, which according to Liebermeister come under common experience and daily observation: namely, that there exists no relation between neglected cleanliness in a place and the diffusion of typhoid, inasmuch as there are many houses in which the bad

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* Researches by Doctor Giuseppe Alessi. Translated by the Misses E. and C. Harvey, and contributed by H. Alfred Roechling as a member of the Institute.

NOTE.—The small figures in the text refer to the literature on this subject, which is given at the end of the paper.

smell from closets is diffused in rooms where people live and sleep, where nevertheless neither those who live continually in them, nor those who stay there for a short time are attacked by typhoid; and in many towns and villages in which the removal of refuse is neglected, the disease is not observed. Nevertheless one single case of typhoid happening in these places would be sufficient to give rise to an epidemic.

According to these opinions then the putrefying materials, which according to Murchison were the specific cause of typhoid, are nothing but a good cultivating medium so to speak, in which the virus of typhoid infection flourishes and from which it is diffused.

The necessity of admitting a specific cause to explain the generation of abdominal typhoid, was the natural consequence of the idea which was gaining ground as to the parasitical nature of infectious diseases—an idea which though apparently correct could only be inexactly demonstrated.

In fact it was maintained that the typhoid virus which left the body of a typhoid patient with the intestinal excretions, was not capable of infecting other individuals, before it had reached a certain degree of development and virulence outside the body. And just in closets, in sewers, in drains overloaded with organic and similar substances it would be able to acquire this virulence, and then rising in the form of minute solid substances, together with the exhalations, it might produce the disease in those who breathed it.

About the year 1880 the sewer gases theory held by the Anglo-American scientists, found favour in Europe with the adversaries of the sewerage system, which according to them served to make worse the hygienic conditions of towns, whether by fetid gases or by germs of diseases which were forced into the streets and houses by the current of air circulating in the network of subterranean pipes.

This renewed favour for Murchison's theory provoked lively discussions in the schools and in many scientific assemblies of that time,[4] and provided subjects for many experimental works. Without entering into the merits of these separate argumentative productions, I shall state certain conclusions with which Zuber terminates one of his critical reviews,[5] and which show how little success the attempt to promulgate the pathogenic theory would have had at that time. Zuber, in fact, said that the action of mephitism in drains, considered as a pathogenic factor, has not been at all defined, the epidemics attributed to this cause being open to many explanations. The conditions then by which mephitism would explain its actions are far from evident, so much the more that experimental pathology has until now given no conclusive answer. There cannot then exist in science a doctrine of epidemics built on so weak a foundation.

Against those then who were endeavouring to make a new version of the old theory, adapting to it fresh bacteriological knowledge, were brought forward the results of experimental studies. It was demonstrated in fact that the gas of sewers did not contain a greater number of bacteria than are generally suspended in the air;[6] that the atmospheric currents in the normal conditions of the drains are not

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capable of raising the pathogenic microbes from the excremental matter;[7] that the direction and intensity of the atmospheric currents in drains are not constant, but variable according to time and place.[8]

Anyhow, the question was subjected, in 1881, to the Congress of Vienna under this title, "Sewer gases as a means of the propagation of epidemic diseases, and the direction and force of the atmospheric currents in sewers." Soyka, who treated the first part of the question, demonstrated, with epidemiological data and experimental facts, that there exists no relation of cause and effect between sewer gas and the propagation of infectious diseases, the prevalence of which happens in a manner absolutely independent of the said gases. Rozsahegyi explained better the idea of his own work on the direction and intensity of atmospheric currents in dark conduits. Finally, Renk affirmed that sewer gases have no epidemiological importance, that they must be considered from the point of view of general hygiene; since, at a certain concentration, they cause a most poisonous combination, and numerous fits observed among sewer men lead one to suppose that it is a question of the noxious influence produced by ammonia and sulphuretted hydrogen. The prolonged action of these gases gives rise to a chronic poisoning, which is accompanied by disturbances of the organs of digestion and nutrition. When the air is very impure and saturated with ammoniacal vapours it obstructs breathing and violently irritates the mucous membrane of the eyes and nostrils. In these workmen, in fact, can be observed those digestive and nutritive disorders, which gradually lead to attenuation and physical and intellectual weakness.

According to Renk then, a great part of the physiological miseries of the poorer classes should be attributed to the abnormal conditions of the air, arising especially from the exhalations from the drains. The gases which issue from them would be, by a kind of chronic poisoning, the causes predisposing to infection.

However, against this hypothesis the observation of facts and daily experience bear witness: these teach us that sewer men, workmen inside sewers, tanners, manufacturers of glue, and other workmen who are forced to live for a great part of the day in foul air, end by not feeling at all the noxious influence; and also with poor people who breathe in bad dwellings the exhalations from closets and filth, it is difficult to demonstrate how much of the physiological misery is due to vitiated air, and how much to the sad effects of scanty food and other anti-hygienic conditions. This, however, does not prevent putrid exhalations, if inhaled for more or less time, from being able to predispose to certain infections and especially to that of typhoid.

And the fact (which with English sanitarians is a dogma of practical hygiene) that infectious diseases and especially typhoid fever are connected with bad exhalations, is most important. The English hygienists therefore consider as injurious to health and life, the emanations which may escape into houses through defective construction of sewers and closets, from accidental flaws in waste pipes, or from any other imperfection in the system of the pipes for carrying away the refuse. And it is precisely this idea which has

brought about the good hygienic arrangement in houses in England, to which also sanitary legislation has contributed, and the diffusion in a popular form of the rules necessary to protect houses from any putrid exhalations. This idea of the English hygienists having been carried out, has given the most magnificent results; therefore, it is useful to see if it has any experimental scientific basis, and this is what forms the subject of this paper.

Experiments.

The idea by which I have been guided in my experiments is this: to see what effects are produced by the typhoid bacillus, even when attenuated, in animals put to breathe in surroundings defiled by putrid gases. Should these researches give positive results, I should be able to reveal whether there really exists a relation between putrid exhalations and the predisposition of the organism to typhoid fever.

The experiments were made on rats, guinea pigs, and on rabbits. The rats were exposed to the exhalations from a closet, untrapped, and so in a condition to give free egress to the gases from the sewer. I kept them in a box whose lower side, made of a network of metal, closed the aperture of the closet.

The guinea-pigs and rabbits were kept in a case whose bottom was also formed of a metal network, under which was placed a vessel in which were excrementitious substances. The animals were fed in the same way as others kept in a normal condition, which were to be inoculated as a control for the preceding.

For the inoculations I have used two cultures of typhoid. The first which was kindly sent me by Professor Bordoni-Uffreduzzi, derived from the laboratory of Koch since 1889; the other is from the collection of the Institute of Rome where it has been cultivated since 1887.

I shall describe the morphological characters of these two cultures.

Culture A, derived from Berlin. The superficial colonies in the gelatine plates have an irregular edge which rises gradually until it reaches the summit of the colony which assumes the appearance of a plateau, on the level of which or a little below is found the central nucleus from which proceed unsymmetrical furrows, shallow and always directed towards the margin. These colonies have always an uniform colour of mother-o'-pearl aspect. The predominant form of the deep colonies is spherical with an irregular edge. Each colony consists of different circles, which, it seems, increase in number as the colony increases in volume. These circles are clearly distinguished because they refract the light and are of different colours, deep yellow, yellow, and pale yellow; in the centre shines out especially a nucleus zone of a yellowish-brown colour.

In the culture in gelatine by puncture the development is slow. On the surface it grows in concentric layers, always with irregular edges and with raised veinings which go from the centre to the circumference. Very occasionally in the thickness of the gelatine a development takes place of gaseous bubbles; but when the inocu-

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lation is made in melted gelatine which solidifies afterwards, the bubbles are almost constantly observed. In this way, in twenty-four to thirty-six hours, with a not very low surrounding temperature, gaseous bubbles are developed, frequently numerous, in all parts of the gelatine, especially towards the bottom of the experiment.

In the tubes of gelatine and of agar with sugar of milk, grape or cane, the development of gas is constant even with inoculation by puncture.

In peptonized broth, slightly alkaline, with the addition of sugar of milk at 2 per cent. and coloured mouldy lake, the blue colour is kept a long time.

The bacilli cultivated in unpeptonized broth with a natural acidity equal to ccm 0·07 of H Cl. and with glycerine at 3 per cent., when observed in hanging drops, show very rapid movements, and pass quickly from one point of the drop to another, taking every direction, separate, in couples, united, in groups, or in little masses.

On *normal* potatoes the bacilli increase, giving rise to a liquid exudation of a yellowish-white aspect, which extending somewhat, takes, in the following days, a yellow colour tending to grey.

On potatoes rendered *alkaline* (carbonate of soda at ½ per cent.) the bacilli form a very thin transparent film, which is enhanced by the brilliance which the surface of the potato assumes in the part where the culture is developed.

On potatoes rendered *acid* (tartaric acid 1 per cent.) even after two days, 37° C, the bacilli give no reaction, and making preparations from points in the neighbourhood of which the inoculation has been made, one remains convinced that the development is scarce. On the preparations bacilliary forms are very rarely observed.

In the milk the bacilli multiply without giving rise to formations of coagulations.

The cultures in broth give no change of character.

Culture B *from the Institute of Rome.* In the superficial colonies on plates of gelatine the irregularity of the margin is much more accentuated than in the superficial colonies of the A typhoid, showing a quite notched appearance.

The central nucleus is somewhat furrowed, and the surface of the colony has pronounced depressions which go from the centre to the margin. The deep colonies are of a spherical form somewhat elongated; inside they shew well marked concentric circles, which are shown up clearly by the different intensity of colour.

The central part contains the nucleus of a deep yellow colour, from which proceed very thin radiating lines which reach the intermediate centres. The cultures by puncture in tubes of gelatine develope with the same slowness as in the A typhoid, also with concentric layers and raised veinings that go from the centre to the circumference but with a less irregular margin.

This culture, besides, discolours the *lacca-muffa* in the cane-sugar broth. There is never so much development of gas in normal agar and gelatine as when they are sugared.

The bacilli cultivated in unpeptonized broth, with a natural acidity and glycerined, move little; the movement is sometimes undulatory, few move from place to place, and many stand still.

The surface of *normal* potatoes with the development of bacilli assumes a damp aspect which is given by the presence of a very thin and transparent layer, under a certain incidence of iridescent light. On the potatoes rendered *alkaline* a very thin skin is formed whose brilliance stands out from the rest of the surface in which the culture has not been developed. On the potatoes rendered *acid* there is no appearance of development. The preparations made with material introduced by a platinum needle rarely show bacilli.

The milk does not coagulate, and the cultures in broth give no change of character.

From these morphological characters that I have passed in review, and on which I have relied to distinguish the cultures derived from animals who have died in consequence of the inoculations, may be deduced that between the two kinds of typhoid bacilli there is no identity; and whilst the **B** culture represents the type described by Gaffky, the **A** culture is very different; the latter ought rather to be classed with the group of the *typhoid-like* bacilli.

Before beginning my observations I have thought it necessary to verify the pathogenic power of these cultures. From the first inoculation experiments made by me with the **B** culture in the peritoneal cavity of rats, kept in normal condition it resulted that it had a certain virulence since the quantity of 0·25 ccm of broth culture was enough to make some of the animals seriously ill, and caused death in others. In fact, on eight rats inoculated two died between the fourth and fifth days, and the others only recovered after the second day.

Therefore in the experiments on rats I used the **A** culture, *whose virulence might be considered almost nil;* these animals bearing well 1 ccm of broth culture inoculated in the peritoneal cavity, and as much as 2 ccm by sub-cutaneous inoculation. Also in guinea-pigs the **A** culture had a very weak pathogenic power; I have assured myself of this by experiment, injecting different quantities from 0·25 ccm to 2 ccm in the peritoneal cavity and under the skin. The guinea-pigs inoculated in the peritoneum with doses of culture above 1 ccm, seemed somewhat depressed, but became brisk again after twenty-four hours. The guinea-pigs inoculated under the skin showed no depression, and only with doses above 0·75 ccm had on the place of inoculation a pulpy tumefaction, which gradually decreased in volume until it completely disappeared.

In the guinea-pigs inoculated with 2 ccm of culture, the tumefaction became hard and formed an incrustation.

The culture **B** injected into the peritoneal cavity with a dose of 2 ccm killed the guinea pigs in from 18 to 24 hours, producing swellings of the spleen, strong congestion of the liver and of the gastro-enteric organs, great distension of the intestinal parieta by the presence of gas, and slight swellings of the Peyer's patches, in the *last* space of the small intestine, and in the follicles of the great

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intestine. Also the mesenteric ganglia appear engorged and have hæmorrhagic spots.

The guinea-pigs inoculated in the peritoneal cavity with 1·50 ccm, and 1 ccm of culture only show a considerable dejection from which they recover after 24 hours; but those inoculated with a quantity smaller than these doses do not feel its action in the least. With subcutaneous inoculations also the guinea pigs survive with 2 ccm of culture, and if the dejection which the strong doses produce ensues, they comport themselves in the same way as with the sub-cutaneous inoculations of the A culture.

I have inoculated two other series of guinea pigs with the same cultures, using nevertheless only the bacilli cultivated on agar with an inclined surface, and this to see if, when eliminating the products elaborated by them, the pathogenic effects would also diminish. The cultures developed on agar were diluted with seven cubic centimetres of sterile broth and inoculated in the peritoneum and under the skin with the same quantity in bulk adopted in the two preceding series.

Although from these experimental inoculations made with cultures in broth, and with cultures in agar, I had obtained results comparable with each other, I have however always preferred in my experiments to inoculate with cultures developed on agar and diluted in broth.

Sections were made of the animals as soon as possible after death, and besides the accurate examinations of the organs to reveal the macroscopic changes, I made of them cultures in gelatine plates, and took out anatomical pieces for the microscopic research of the bacilli.

My experiments are in two sets: in the first are comprised those made on animals placed to breathe putrid gases emitted by excrementitious matter; and in the second set, those executed on animals placed to breathe certain chemical substances which are found in the form of gas in putrid fermentations.

The first set of experiments is composed of three series, I having used three kinds of cultures for the inoculations—*i e.*, typhoid bacilli of the A culture of Berlin, those of the B culture of the Institute of Rome, and a culture of *bacterium coli.*

I will now describe the results of these three series of experiments.

FIRST SET OF EXPERIMENTS.

First Series.—Bacilli of Typhoid, Culture A.

Experiments on Rats.

The rats which were placed to breathe the exhalations from the closet, lost after a certain time their usual vivacity, and pined away, in spite of eating voraciously. When inoculated with a relatively small quantity of culture (0·55—0·50 ccm) they succumbed in from twelve to thirty-six hours; the few surviving revived, after several days, from the profound depression into which they had fallen from the effect of the inoculation.

The animals kept in normal condition, inoculated in control with

an equal quantity of the same culture, did not for the most part feel any hurtful effects; a few seemed rather depressed, and only one of them died.

The results of these experiments are collected in the following Table:—

First Series. Experiments on Rats. Typhoid Culture **A.**

TABLE I.

Number.	Days on which the animals have been subjected to experiment.	Days on which the animals have been inoculated.	Number of prepared animals.			Number of animals in control experiment.		
			Inoculated.	Died.	Survived.	Inoculated.	Died.	Survived.
I.	28th Nov., 1892.	3rd Dec.	2	0	2	2	0	2
II.	5th Dec.	20th „	3	2	1	8	1	7
		23rd „	3	2	1			
		26th „	2	2	0			
		2nd Jan., 1893..	2	2	0			
III.	4th Jan., 1893..	12th „	3	1	2	6	0	6
		18th „	3	2	1			
		20th „	2	2	0			
IV.	15th „	20th „	2	2	0	8	1	7
		28th „	4	4	0			
		30th „	3	2	1			
		3rd Feb.	3	3	0			
V.	4th Feb.	12th „	4	2	2	8	0	8
		16th „	2	1	1			
		20th „	2	2	0			
VI.	24th „	9th March	2	1	1	9	1	8
		28th „	1	1	0			
		2nd April	2	2	0			
		26th „	2	2	0			
		7th May	2	2	0			
		Totals	49	37	12	41	3	38

On making sections of the animals, which had died in consequence of the inoculation, I have gathered the following post-mortem characteristics:—

Great emaciation, muscles thin and reddish.

The peritoneal serosa is injected and slightly opaque. Some fibrino-purulent spots are found on the peritoneal surface, which is much congested and distended by gaseous expansion inside the parietæ. The intestines are much congested and distended by gas. This distension is not spread through all the coils of the small intestine, but is very evident in some.

Through the serosa of the small intestine appears the deep red tint of ecchimotic spots and of hemorrhagic infusions.

In the free margin of the small intestine opposite the insertion of the mesentery are seen dark lenticular spots. The intestine having been opened along the line of the mesenteric insertion, the intestina

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lumen is seen full of liquid, in some parts of a serous appearance, in others bloody.

The contents of the intestines having been removed, the mucus is seen to be intensely hyperæmic, swollen, suffused here and there with hemorrhage, in some parts with rather large spots. In some parts of the intestine where the secretion was abundant, the mucus was completely exfoliated. In the last part of the small intestine Peyer's patches were seen rather distinct from the mucus, from which they showed up by their bright red colour or a greyish tint; they correspond to the dark lenticular spots which appeared through the serosa.

The spleen is rather increased in volume and hyperæmic.

The liver of soft consistency, in the greater number of cases is congested, especially when the death of the animal took place quickly.

The mesenteric glands are swollen, of a grey colour, of soft consistency, and rich in blood. The supra-renal capsules are bright red and much injected with blood. The kidneys, macroscopically at least, show nothing abnormal, except in some cases where they are slightly swollen.

Once only I found the lungs swollen, once the pericardium contained a purulent exudation, and three times the pleuræ contained sero-purulent liquid.

From bacteriological researches made in various visceræ, in the blood of the heart, and in exudations, the result was that typhoid bacilli were constantly met with. The cultures in plates have nearly always given colonies of typhoid alone, and only in cases where the death of the animals has been more than usually retarded, there have been found together with typhoid colonies, those of other micro-organisms, as a bacillus liquefying rapidly the gelatine, similar to the *Proteus vulgaris* and the *Staphylococcus pyogenes albus*.

In the following table are collected the results of the bacteriological experiments made on the parenchymal organs and on the exudations:—

First Series. Experiments on Rats. Typhoid Culture **A.**

TABLE II.

Cultures were made from.	Number of cultures made.	Number of times in which typhoid colonies were developed.
Pericardium with purulent exudation ...	1	1
Blood from the heart	37	37
Pleuræ with sero-purulent exudation... ...	3	3
Lungs congested	1	0
Peritoneum	14	14
Liver	11	10
Spleen	37	37
Mesenteric ganglia engorged	7	4

The microscopic examination of the bacilli was made after treating the sections of the organs, previously hardened, by the noted method of Kühne. This method offers the advantage of double colouration, and makes the bacilli show up better, being coloured with methyl blue on the golden yellow used for the contrasting colour.

In the sections of the liver and of the spleen the bacilli are rare and found for the most part in little red accumulations. Following the course of the longitudinal sections of the large vessels of these organs, the bacilli are seen disseminated in the bloody mass.

In the sections of the swollen Peyer's patches the thickened portion of the mucus is invaded by bacilli, which are seen in larger numbers around the follicles and inside the follicular parenchyma itself. It is, however, to be noticed that the bacilli do not invade the mucus equally in the whole cut surface of the patches; they form rather large accumulations distributed in different points of the same patch.

In those animals then, from whose bodies other micro-organisms have been separated besides the typhoid colonies, observations gave rather different results, for example: the sections of the liver and of the spleen presented foci of micrococci, which were most abundant in the Peyer's patches. In the cases in which the culture had given evidence of a mixed bacilliary infection, the liver, the spleen and the Peyer's patches showed bacilli, the greater number of which were scattered separately through all the parenchyma of the organs.

It results, hence, from these experiments that rats put to breathe the exhalations from the closet acquire a great susceptibility to the action of the typhoid bacillus; in fact they succumb to the inoculation of typhoid bacillus, even when attenuated, showing to macroscopic examination signs of hemorrhagic enteritis, and enlargement of volume of the Peyer's patches and of the spleen. In the tissues, especially in the liver, the blood, and the spleen the typhoid bacilli are found, as the microscopic researches and the cultures have shewn.

Experiments on Guinea-pigs.

The guinea-pigs exposed to putrid gases begin, after some days, to lose their hair and become wasted, although they eat with unusual voracity. Thus treated, they succumb to the sub-cutaneous inoculations of 0·25—0·50 ccm of culture in a period of time varying from one to thirteen days; while the guinea-pigs kept in normal conditions, and inoculated with the same quantity of the same culture, feel no effect.

Let us resume in the following Table the results of these experiments.

[redacted]

First Series. Experiments on Guinea-pigs. Typhoid Culture **A.**

TABLE III.

Number.	Days on which the animals have been put to breathe putrid gases.	Days on which the animals have been inoculated.	Number of prepared animals.			Number of animals in control experiment.		
			Inoculated.	Died.	Survived.	Inoculated.	Died.	Survived.
I.	16th March	2nd April	4	4	0	3	0	3
		15th „	4	3	1	3	0	3
II.	19th April	3rd May	5	5	0	4	0	4
		7th „	6	6	0	4	0	4
III.	7th May	20th „	6	6	0	4	0	4
IV.	25th „	5th June	4	3	1	3	0	3
		12th „	6	4	2	4	0	4
		7th July	2	2	0	2	0	2
V.	30th June	7th „	4	4	0	3	0	3
		14th „	4	3	1	4	0	4
		27th Aug.	1	1	0	1	0	1
VI.	16th July	24th July	7	5	2	4	0	4
VII.	25th „	11th Aug.	8	5	3	5	0	5
		27th „	7	4	3	4	0	4
		21st Sept.	4	2	2	2	0	2
		Totals	72	57	15	50	0	50

The dead animals show an excessive emaciation; in the subcutaneous tissue is found an edematose infiltration limited to the point of inoculation.

In the abdominal cavity comes a certain quantity of turbid liquid, viscous, and in some cases of bloody aspect. The serosa is opaque and injected with blood, and on the intestinal coil, or floating in the peritoneal liquid, are found flakes of fibrous exudation.

The stomach, the small, and often the large intestine are swollen with gas. Intestinal ectasia prevails in the last space of the small intestine.

The intestinal contents are abundant, serous, and often hemorrhagic.

The mucous membrane is hyperæmic, especially at the pyloric orifice, the hyperæmia extending to the whole of the small intestine; it is accentuated in the small, and frequently in the first portion of the large intestine. Many of the Peyer's patches are enlarged, of a grey colour, and some also strewed with hemorrhage.

The lymphatic ganglia of the mesentery are enlarged in volume, are much congested, and exhibit ecchimotic spots.

The spleen is nearly always greater than at the normal, sometimes of normal, sometimes of port wine colour. The liver is also augmented in volume, and shows a deep red tint, the constituence is much diminished, and it liquefies easily. The gall-bladder sometimes contains bloody liquid. The supra-renal capsules are intensely hyperæmic, the kidneys augmented in volume. The testes exhibit ecchimotic spots. The uterus, especially in cases where gestation is found, is much congested. In the thoracic cavity the pericardium is distended

by liquid, clear or purulent; the pleura contain a little clear liquid, and sometimes the lungs appear congested.

This is the post-mortem appearance of those guinea-pigs who have died after twenty-four hours. In those which died after the third day the alterations described are less pronounced.

The gastro-enteric mucus is found to be in a state of catarrhal inflammation; the Peyer's patches are swollen, but pale.

In the guinea-pigs which died after the ninth or tenth day from the inoculation, I have met with many punctiform and even perforated ulcerations of the Peyer's patches.

In these guinea-pigs the follicles of the colon exhibit sufficiently pronounced hyperplasia.

In those cases besides, in which the death of the animals has been late, the liver and the spleen were pale and flaccid, the mesenteric ganglia engorged, exteriorly of grey colour and interiorly of muddy white, and of soft consistency.

From the bacteriological observations made on these animals, it results that the typhoid bacilli are found nearly always in all the organs of which cultures were made; it is to be noticed however that the animals which died after twenty-four hours contain in the tissues, only typhoid bacilli as may be seen from the cultures on plates. But in the animals who died after the the third day the typhoid bacilli are found often in company with other micro-organisms. The value which the presence of these micro-organisms may have will be shewn, when I have stated the result of the bacteriological examination of the different series of animals under experiment.

I now give, in the following Table, the results which refer to the examination of the typhoid bacilli in the organs:—

First Series. Experiments on Guinea-pigs. Typhoid Culture **A.**

TABLE IV.

Cultures were made from.	Number of cultures made.	Number of times in which typhoid colonies were developed.
Pleuræ fluid	2	1
Blood from the heart	52	41
Peritoneal fluid	52	45
Liver	52	45
Bile in the gall-bladder	34	29
Spleen	52	44
Engorged mesenteric glands	12	10
Placental tissue	1	1
Amniotic fluid	1	0
Fœtus	1	0
Urine in bladder	5	3

In the microscopic sections of the liver and of the spleen, the parenchymal tissue is strewn with bacilli, single or united in groups also numerous; in the lumen of the vessels and around their walls

[redacted]

they are seen in great numbers. Following the course of the large vessels, in the parts where they are cut longitudinally, bacilliary forms are seen in infinitesimal numbers, mixed with the blood clots whose course they evidently follow.

In the cases in which the bacteriological examination had shown a mixed infection, in sections of the liver and of the spleen, besides the bacilliary forms micrococci were observed scattered or united in multiple foci.

In the Peyer's patches the bacilli are found sometimes in the mucus, in separate numerous groups distributed through the whole of its thickness, especially around and in the follicles. Besides the bacilliary invasions some patches show accumulations of micrococci, in the surface layers of the mucus and in some cases in its whole thickness.

In the sections of the engorged mesenteric glands is to be seen a comparatively small number of bacilli in the lacunar spaces, much dilated, and among the hemorrhagic spots which occupy large spaces between the parenchyma and the cortical tissue; but it is only in some points of the glandular stroma adjoining, and among the trabiculæ of the medullary stratum, that rather numerous groups of bacilli may be observed.

Experiments on Rabbits.

Not less important than the preceding experiments are those made on rabbits. These, subjected to the same treatment as the guinea-pigs of which we have already spoken, become perceptibly thinner, lose their hair, and in a short time acquire the receptivity to the action of the typhoid bacillus. Inoculated with culture in the quantity of 0·25 to 0·50 ccm, they die between the second and fourth day.

I have collected the experiments on these animals in the following Table:—

First Series. Experiments on Rabbits. Typhoid Culture A.

TABLE V.

Number.	Days on which the animals have been put to breathe putrid gases.	Days on which the animals have been inoculated.	Number of prepared animals.			Number of animals in control experiment.		
			Inoculated.	Died.	Survived.	Inoculated.	Died.	Survived.
I.	4th Aug.	11th Aug.	1	1	0	1	0	1
II.	14th „	21st „	1	1	0	1	0	1
III.	24th „	7th Sept.	1	1	0	1	0	1
IV.	7th Sept.	13th „	2	2	0	1	0	1
V.	16th „	19th „	2	2	0	1	0	1
VI.	21st „	25th „	4	4	0	2	0	2
		Totals	11	11	0	7	0	7

At the autopsy the rabbits exhibit great swelling of the abdomen and general emaciation; the muscular tissue shows a reddish tint.

The intestines are distended by gas and are hyperæmic. The

intestinal mucus is swollen and hyperæmic; the hyperæmia is more accentuated in the parts corresponding to the swollen Peyer's patches. In some animals may be observed some patches with incipient ulceration. Once I found the small intestine perforated; another time the colon exhibited considerably swollen follicles containing pus, and some ulcerated.

The Peyer's patch which was found on the small intestine, at the point at which it opens into the colon, was very large, attaining the proportions of a halfpenny.

The mesenteric ganglia are engorged, of a dirty white colour, with contents of soft consistency.

The spleen and the liver are of the normal dimensions, but are rather congested.

The distribution of the bacilli in the organs, according to the bacteriological investigation, is as follows :—

First Series. Experiments on Rabbits. Typhoid Culture A.

TABLE VI.

Cultures were made from.	Number of cultures made.	Number of times in which typhoid colonies were developed.
Pericardial fluid	1	1
Blood from the heart	11	9
Peritoneal fluid	8	8
Liver	10	5
Bile in the gall-bladder	6	4
Spleen	11	11
Engorged mesenteric ganglia	6	2
Urine in bladder	11	11

The microscopic examinations of the sections of the liver and the spleen has given a result identical with that of the guinea-pigs.

The mesenteric ganglia nevertheless were nearly always found to be invaded by micrococci; in the sections made at the level of the hyperplastic Peyer's patches, in the surface stratum of the mucus, are seen accumulations of micrococci; whilst in its deep layer, and often also in the muscular layers, typhoid bacilli are very numerous.

The rabbits, therefore, like the guinea-pigs, breathing putrid gases, acquire the predisposition to typhoid infection, which determines, in their organism, much more evident and characteristic changes than in the animals of the preceding experiments.

FIRST SET OF EXPERIMENTS.

SECOND SERIES.—BACILLI OF TYPHOID, CULTURE B.

Experiments on Guinea-pigs and Rabbits.

Since the bacilli of typhoid culture in rats placed in ordinary conditions attained some degree of virulence, I have limited myself to experiment with it on guinea-pigs and rabbits, which, in a normal *state*, as I have said before, resist without serious consequences sub-

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cutaneous inoculations of 2 ccm of this culture. While the minimum fatal dose for sub-cutaneous inoculation is 0·25 ccm in prepared animals.

In the following table are summed up the experiments made on guinea-pigs and on rabbits.

Second Series. Typhoid Culture **B.**
TABLE VII.

Number.	Days on which the animals have been put to breathe putrid gases.	Days on which the animals have been inoculated.	Number of prepared animals.			Number of animals in control experiment.		
			Inoculated.	Died.	Survived.	Inoculated.	Died.	Survived.
	Experiments on Guinea-pigs.							
I.	28th Sept.	3rd Oct.	14	13	1	7	0	7
II.	7th Oct.	15th „	2	2	0	4	0	4
		16th „	1	1	0			
		21st „	2	1	1	2	0	2
		28th „	2	1	1	2	0	2
III.	19th „	24th „	4	1	3	2	0	2
IV.	20th „	28th „	2	2	0	2	0	2
		Totals	27	21	6	19	0	19
	Experiments on Rabbits.							
V.	24th Oct.	24th Oct.	1	1	0	1	0	1
VI.	28th „	30th „	4	3	1	3	0	3
		1st Nov.	2	2	0	1	0	1
		4th „	1	1	0	1	0	1
		Totals	8	7	1	6	0	6

The greater number of guinea-pigs died in from eighteen to twenty-four hours. Some nevertheless survived till the fifth or sixth day. In the rabbits death supervened in a period of time varying from one to three days.

In the guinea-pigs and in the rabbits the post-mortem results are the same, and differ from those of the preceding series of animals by the greater intensity and diffusion of inflammatory symptoms. In fact these exhibit an edematous hemorrhagic infiltration diffused throughout the sub-cutaneous cellular tissue of the abdomen, congestion of the abdominal visceræ, and also of the lungs.

The peritoneal and pleural cavity contain abundant liquid and bloody exudation. The intestinal mucous is hyperæmic and swollen, and only some of the Peyer's patches are hyperplastic.

The distribution of micro-organisms in the parenchymal organs and in the Peyer's patches has much analogy with that which has already been described in the animals of the preceding series. I therefore refrain from stating their details.

From the bacteriological researches it has resulted that, nearly always, typhoid bacilli *only* have been found in the organs which

have been examined; only a few times have I found other micro-organisms associated with those of typhoid.

The results of the bacteriological examinations are to be found in the following tables:—

Second Series. Typhoid Culture B.

TABLE VIII.

Organs and tissues from which the cultures were made.	Number of cultures made.	Number of times in which typhoid colonies were developed.
Experiments on Guinea-pigs.		
Pleuræ	1	0
Blood from the heart	21	19
Peritoneum	18	17
Liver	18	17
Bile in the gall-bladder	8	4
Spleen	21	20
Amniotic fluid	1	0
Placenta	1	1
Fœtus	1	1
Urine in bladder	2	2
Experiments on Rabbits.		
Blood from the heart	7	5
Peritoneum	7	6
Liver	7	5
Spleen	7	6
Subcutaneous œdema	1	1

By the distribution then of the typhoid bacilli in the various tissues, and by the alterations which they have caused in them, I am justified in concluding that they have caused death in these animals, following upon the predispositions which the latter had acquired by breathing putrid gases.

FIRST SET OF EXPERIMENTS.

THIRD SERIES.—BACTERIUM COLI.

Experiments on Guinea-pigs.

I wished to see if besides typhoid bacilli *bacterium coli* of attenuated virulence was also capable of producing infection and death in animals exposed to a treatment with putrid gases. I therefore made use of a culture of *bacterium coli*, whose bacilli inoculated under the skin of normal guinea-pigs at a dose of from 0·25 to 1 ccm showed no evident change either local or general; but in a quantity of 1·50 and 2 ccm they produced a considerable depression, and in the point of inoculation they always formed a rather large pulpy swelling, which disappeared at the end of six or seven days.

The guinea-pigs put to breathe putrid gases, inoculated under the

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skin with 0·25 or 0·50 ccm of culture, died in a time varying from eight hours to three days.

The post-mortem characteristics that I met with in their bodies were an acute inflammation diffused through all the abdominal organs, and sometimes also in the lungs.

The bacteriological examination always gave the bacterium coli alone; and this examination also shows that in guinea-pigs put to breathe putrid gases the susceptibility to infection from bacterium coli is also augmented.

In the following Tables I have set forth the mortality of these animals and the distribution of bacterium coli in their organism.

Third Series. Experiments on Guinea-pigs. Bacterium Coli Culture.

TABLE IX.

Number.	Days on which the animals have been put to breathe putrid gases.	Days on which the animals have been inoculated.	Number of prepared animals.			Number of animals in control experiment.		
			Inoculated.	Died.	Survived.	Inoculated.	Died.	Survived.
I.	31st Oct., 1893...	4th Nov..........	2	1	1	2	0	2
		9th „	3	3	0	2	0	2
		12th „	2	2	0	2	0	2
		15th „	1	0	1	1	0	1
II.	11th Nov..........	15th „	4	4	0	3	0	3
		Totals.........	12	10	2	10	0	10

Third Series. Experiments on Guinea-pigs. Bacterium Coli Culture.

TABLE X.

Cultures were made from.	Number of cultures made.	Number of times in which typhoid colonies were developed.
Pericardial fluid	1	1
Blood from the heart	10	10
Peritoneal fluid	10	10
Liver	10	10
Bile in the gall-bladder	1	1
Spleen	10	10

The experiments which I have already set forth show clearly *that putrid gases when breathed, exercise a great influence on the animal organism, predisposing it to the action of typhoid bacillus, a variety of the same, and of bacterium coli even when attenuated.* This result serves to revive the opinion of Liebermeister, who following the idea of Budd, and combating the old belief, had known intuitively that in outbreaks of typhoid epidemics special conditions, both individual and local, are necessary besides the presence of the specific virus.

But let us examine the results which have led to this conclusion. We have seen that the animals set to breathe putrid gases lose their natural immunity from typhoid infection; and that this may take

place, it is necessary that they should remain in it periods varying according to the individual, as is shown in the following Table:—

Time necessary for the animals to acquire the predisposition.

TABLE XI.

Kind of Culture.	Animals under experiment.	Time necessary for the animals to acquire predisposition. Minimum time.	Average time.	Maximum time.
		Days.	Days.	Days.
FIRST SERIES. Typhoid Bacilli (Culture A)...	Rats..................	5	22	72
	Guinea-pigs	7	18	58
	Rabbits	3	5	18
SECOND SERIES. Typhoid Bacilli (Culture B)...	Guinea-pigs	5	6	21
	Rabbits	0	3	6
THIRD SERIES. Bacterium Coli	Guinea-pigs	3	6	12

Moreover, the time necessary to acquire this predisposition varies according to species, since rats show more resistance than guinea-pigs and guinea-pigs than rabbits.

It appears that generally the animals acquire the predisposition to infection more easily during the first two weeks than after that time. In fact, 90 per cent. of the animals inoculated in the first two weeks died, and 76 per cent. of those inoculated in the following weeks.

This fact may in a certain degree explain how it is that some individuals who habitually breathe air from sewers, or in whatever way corrupted, end by becoming habituated to it, and are no longer attacked by intestinal infections.

I now give in two Tables the percentage figures which refer to the mortality of the animals, and those which indicate the time which transpired between the day on which the animals were inoculated, and that on which death has supervened.

Summary of Results obtained.

TABLE XII.

Kind of Culture used.	Animals under experiment.	Percentage Mortality of all animals. Prepared animals.	Animals in control experiments.
		Per cent.	Per cent.
FIRST SERIES. Typhoid Bacilli (Culture A).........	Rats	75·0	7·0
	Guinea-pigs	79·0	0·0
	Rabbits	100·0	0·0
SECOND SERIES. Typhoid Bacilli (Culture B).........	Guinea-pigs	80·0	0·0
	Rabbits	70·0	0·0
THIRD SERIES. Bacterium Coli..........................	Guinea-pigs	83·3	0·0

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Time elapsed between the inoculation with the bacilli and the death of the animals.

TABLE XIII.

Kind of Culture.	Number of animals under experiment.	Time elapsed between the inoculation with the bacilli and the death of the animals.
FIRST SERIES. Typhoid Bacilli (Culture A)	Rats 9	12 to 24 hours.
	„ 25	24 „
	„ 3	24 to 36 „
	Total 37	
	Guinea-pigs ... 18	24 „
	„ ... 6	3 days.
	„ ... 6	4 „
	„ ... 3	5 „
	„ ... 8	9 „
	„ ... 8	10 „
	„ ... 3	13 „
	Total 52	
	Rabbits 3	2 „
	„ 4	3 „
	„ 4	4 „
	Total 11	
SECOND SERIES. Typhoid Bacilli (Culture B)	Guinea-pigs ... 15	18 to 24 hours.
	„ ... 3	30 „
	„ ... 1	2 days.
	„ ... 1	5 „
	„ ... 1	6 „
	Total 21	
	Rabbits 1	24 hours.
	„ 3	2 days.
	„ 3	3 „
	Total 7	
THIRD SERIES. Bacterium Coli	Guinea-pigs ... 1	8 hours.
	„ ... 3	20 „
	„ ... 2	24 „
	„ ... 1	2 days.
	„ ... 3	3 „
	Total 10	

The figures which refer to the mortality of the animals experimented upon speak for themselves, the more so when we consider the attenuated virulence of the typhoid culture, and the small quantity inoculated—that is from 0·25 to 0·50 ccm; while Chantemesse and Vidal,[9] Sanarello[10] and Agrò,[11] in order to produce death in animals, have been obliged to inoculate with from 2 to 4 ccm of a typhoid culture whose virulence they had been able to increase.

The results then obtained by me confirm the fact, admitted by

practical hygiene, of the great importance which putrid gases have in the development of intestinal infections like typhoid. However, the said facts may be variously interpreted; for example, is the great mortality following on the inoculation of the typhoid bacilli due to the organic predisposition following upon the inhalation of putrescent gaseous substances, or to a double infection, *i.e.*, to the concomitant action of the other micro-organisms often found in the autopsy, in association with the typhoid bacilli, and casually arising from the putrid surroundings? In typhoid infection in man, Eberth's bacillus is not infrequently found associated with other micro-organisms. This in fact is found together with the streptococcus by various authors, among whom are Nitter,[12] E. Fränkel,[13] Karlinsky,[14] and Vincent.[15] According to the facts demonstrated by Vincent,[16] the gravity of the typhoid infection must be judged in relation with the streptotific analogous life, from which an exceptional virulence results, due to the poisonous principles elaborated in the organism from the simultaneous development of the two micro-organisms.

The micro-organisms which in my experiments I have found together with the typhoid bacilli, and which have been separated from the plate cultures, are the following:

The white staphylococcus;
The small micrococcus;
A bacillus resembling the Proteus vulgaris.

From the inoculations of these organisms executed on rats, guinea-pigs and rabbits, the result was that they had no pathogenic power; besides this, in inoculating the mixtures, alias the cultures of analogous forms of life, with typhoid bacilli, I am convinced that no increase of virulence is obtained.

From these observations, therefore, I think I may conclude that the death of the animals is not to be attributed to the micro-organisms associated with the typhoid bacilli, but it ought rather to be admitted that they penetrated into the organism when the organic power of resistance had yielded to the action of the inoculated typhoid bacilli. In fact such a penetration could easily be explained, supposing that in some points of the tissues alterations had taken place, such as to give access to the micro-organisms which were in contact with them. This fact is especially demonstrated by the foci of micrococci observed in the sections of the Peyer's patches through which the invasion probably entered.

SECOND SET OF EXPERIMENTS.

After having thus studied the predisposing action of putrid gases taken in their entirety, it remains to examine *whether the chemical substances which are commonly given out in the form of gas from putrid fermentations, can also exercise separately a similar influence on the animal organism.*

It is known that a cubic metre of excremental matter can give out in twenty-four hours about 18 cbm of gas, of which 10 cbm are of

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fatty acids and hydro-carbons; 5-6 cbm are of carbonic acid; 2-3 are of ammonia; 20 litres of sulphuretted hydrogen.

These gases, considered separately, constitute for man and animals the most poisonous substances, and their combination produces very rapid deleterious effects. It interested me to study their action on the animal organism in very small doses—certainly smaller than the minimum fatal dose—having reference to the possible conditions of air-pollution of houses, through gases arising from badly constructed closets, filth and other causes, where the doses can only be found weakened, as even in such surroundings natural ventilation is constantly diluting these gaseous productions.

The substances which I adopted for these experiments are the following: Retilindol, Ammonia, Sulphuretted Hydrogen, Methyl Sulphide, Carbonic Acid, Carbonic Oxide, Ammonium Sulphide.

The animals on which I experimented were put to breathe the gases inside a large bell glass, which was closed in such a manner as to make change of air possible.

After a certain time I inoculated with typhoid bacilli, in the same manner as in the preceding experiments. The results which I obtained are collected in the following Table:—

SECOND SET OF EXPERIMENTS.

Experiments with various gases.

TABLE XIV.

Substance experimented with.	Animals under experiment.	Day on which the experiment began.	Day on which Typhoid inoculations were made.	Prepar'd animals.		Animals in control experiment.	
				Inoculated.	Died.	Inoculated.	Died
Retilindol	Rats	24 May	5 June	1	0	1	0
	"	24 "	28 "	5	0	4	0
Ammoniacal vapours	"	7 July	23 July	4	0	4	0
	"	7 "	30 "	4	0	4	0
Sulphuretted hydrogen	"	28 "	11 Aug.	8	1	4	0
Methyl sulphide	"	16 Aug.	25 "	8	0	5	0
Carbonic acid	"	29 "	7 Sept.	5	0	3	0
Carbonic oxide	Guinea-pigs	13 Sept.	21 "	4	1	3	0
Retilindol and methyl sulphide	Rats	21 "	2 Oct.	4	0	3	0
Retilindol, methyl sulphide, and ammonia	"	6 Oct.	15 "	5	0	3	0
Sulphide of ammonium	"	21 Sept.	2 "	4	1	[illegible]	0
Sulphide of ammonium & methyl sulphide	Guinea-pigs	6 Oct.	15 "	4	0	3	0

Therefore the above-mentioned gases or vapours, taken separately, do not predispose animals to typhoid infection. In fact, in all the

experiments only three animals died, and those from other causes, which it was impossible for me to define. And not only did the gases taken separately have no predisposing effect, but even some of them when mixed; for which reason I may be allowed to suppose that both the exhalations arising from fæcal matter, and the exhalations arising from organic matter in putrefaction, are not composed of simple mixtures, but are much more complicated than might be believed. And the predisposing cause might also have its seat in those fetid substances of neutral character, which it is impossible either to understand or determine, whether from their small quantity, the insufficiency of analytical methods, or from the imperfection of those which we already have. In any case, from my experiments can be drawn this useful lesson, that the above-mentioned gases or vapours can be breathed in small doses without their predisposing to typhoid infection.

From my researches, taken altogether, I think I am authorised to conclude that—

1. The inspiration of putrid gases predisposes the animals (rabbits, guinea-pig, rats) to the pathogenic action of even attenuated typhoid bacilli, and of bacterium coli;
2. This predisposition is due to the combination of gases given out by putrid fermentations, and not to any one separately;
3. It is probable that this experimental predisposition is diminished by prolonged breathing of the said gases.

These conclusions then serve to confirm what some authors had epidemiologically foreseen, and social hygiene had practically and painfully confirmed.

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9. Annales de l'Institut Pasteur. 1892, p. 755.
10. Ibidem. p. 721.
11. Annali dell 'Istituto d'Igiene di Roma. 1893, p. 477.
12. Soc. Médic. des Hôpitaux. 6th March, 1891.
13. Zur Lehre von der Aetiologie der Complicationen in abdominal Typhus. Iahrbücher der Hamburgischen Staats Krankenanstalten. 1890.
14. Fortschritte der Medicin n. 18. 1889.
15. Soc. Médic. des Hôpitaux. 13th November, 1891.
16. Annales de l'Institut Pasteur. 1893, p. 141.

THE HERMITE PROCESS FOR SANITATION OF TOWNS.

BY EDWARD J. PATERSON, M.I.E.E.

THE readers of this Journal are probably cognizant that a process under the above name, and which claims to be a distinct and novel departure in the improved sanitation of towns, has been the subject of important demonstrations in France and in England, and has been definitely adopted and installed by the Corporation of Ipswich, and also by the War Office at the Victoria Hospital, Netley.

The process claims to obtain by the electrolysis of sea water or similar saline solutions, a disinfectant and deodorizer far more efficient and less costly than any other known substance, in fact, at so low a cost that it may be applied to the cleansing and disinfecting of the sewers of a town, and results in a great improvement of the effluent sewage at a cost which is covered by a nominal charge on the rates.

The contention of the inventors is, that in any town however perfect the system of sewerage, the existence of large volumes of putrescent matter flowing through the sewers and giving forth to the atmosphere, and into the houses where the drains

are defectively trapped, gases which mix with the air breathed by the inhabitants, is a source of danger to the health of the town. Also that the attempts made to minimise the evil by ventilating shafts are futile and costly; and that no treatment of sewage can be satisfactory but one that prevents putrefactive changes till the sewage is outside the bounds of the town, and that the only way to effect this is to mix the sewage with an efficient antiseptic as soon after its production as possible.

The writer is aware that experts, whose opinion demands respect, have denied that there is any evidence of pathogenic germs existing in the sewer air, and, therefore, contend that sewer gases cannot be directly productive of typhoid and other diseases, notwithstanding the general opinion of the medical faculty to the contrary. In the number of this Journal for April, 1895, Dr. Louis Parkes has very ably reviewed this question from both sides, and says that though it is "difficult to understand how specifically infected sewage plays any part at all in the dissemination of typhoid fever, yet that it does so is, perhaps, one of the best recognised facts in the science of preventive medicine." The burden of the proof to the contrary rests with the Bacteriologists, and in the meantime the almost universal belief in the toxic qualities of putrescent sewage, and the gases arising from it, may be considered as not having been effectively or even seriously controverted.

The apparatus used in the Hermite process for electrolysing sea water, is one specially designed and perfected at great cost and after lengthened trials. It consists of a galvanised-iron tank in which are platinum and zinc electrodes of very considerable superficial area. The platinum electrodes are constructed of platinum wire gauze; the zinc electrodes are discs of pure zinc, a series of which are threaded upon two spindles, with room between them for the platinum electrodes to be inserted. The zinc electrodes, being attached to a spindle, revolve, and have scrapers acting on them for the purpose of removing the deposit of magnesium oxide which coats their surface during the electrolysis. The normal size of these electrolysers is such that a current of 1,000 or 1,200 amperes may be employed, and the electromotive force, which of course varies slightly according to the density of the solution, may be taken approximately at 6 volts. On filling the tank with sea water, and passing the current through the electrolyser, the electrolysis of the sea water is brought about.

The chemical changes which take place are a little obscure, and any explanation that has been given, limiting them to the production of hypochlorites of a similar nature to those contained in bleaching powder, (with the substitution of magnesia

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for lime as a base) are not sufficient to account for the remarkable disinfecting power of the sea water after electrolysis. The results of the electrolysis are of a complex nature and seem to point to the production of two or more distinct antiseptic products, one of which (the hypochlorite) is tolerably stable, and the others exceedingly unstable, but at the same time of high antiseptic power. Dr. Rideal, in his work on disinfectants, has referred to the antiseptic properties of peroxide of hydrogen and also of the periodates and hints at the probability of their existence in the hermite solution (pp. 76 and 84); and it is probable that here we have a clue to the chemical changes which account for the remarkable properties of electrolysed sea water prepared by the Hermite process, as all the conditions necessary for the production of these substances appear to be present. Anyway, it is a fact, that hermitine (as the Hermite Solution is called) loses much of its antiseptic properties if allowed to get stale, and it is very unfortuate that some of the tests on the antiseptic value of hermitine have been made by eminent chemists with stale solution, and that where this has been done its value has been much underrated.

For purposes of comparison, the chemical tests made of the hermitine have ignored these unstable products, and simply dealt with the amount of available chlorine per litre, as shewn by the arsenious acid test. As the production of hypochlorites may be presumed to be always accompanied by that of the more unstable products, this test may be considered, perhaps, as being adequate to the purpose in view—at all events with freshly prepared samples.

The sea water is electrolysed till it shows with the arsenious acid test, from half a gramme to one gramme per litre of chlorine. It is generally admitted by the experts who have reported on the process, that if sufficient hermitine be added to the sewage of the town to give one gramme of chlorine per head of population per 24 hours, effective deodorization and arrest of fermentation for two days is secured; and that an increase of the amount to 2, 3, 4, 5, or 6 grammes per head results in the complete destruction of micro-organisms, the pathogenic ones succumbing to 2 or 3 grammes per head, and the more resistant spore breeding organisms to stronger doses. Samples of sewage, treated with 2 or 3 grammes per head, have been found to keep free from smell and fermentation for 14 days, that is, until in the ordinary course of things, the sewage would have been far out at sea.

The properties of hermitine have been investigated by various eminent experts, and (except where as stated above a stale solution has been employed and its antiseptic value underrated)

their reports are eminently satisfactory. These reports comprise those of Dr. Ruffer and Sir Henry Roscoe for the British Institute of Preventive Medicine; Dr. Piton of the Naval School at Brest; Dr. I. de Christmas of Paris; a Commission specially appointed by the "Lancet;" one by Mr. Napier, the County Analyst of Ipswich, and a suggestive one by Dr. Jenkins, the Medical Officer of health for Lytham.

In some of the trials made with Hermite Solution, it was applied to fresh fœcal matter direct from the water-closet and not to liquid sewage. Mons. Hermite's aims were directed to the complete sterilisation of fœcal matter by using hermitine to replace the ordinary flush for the closet, he having in his mind the sanitary needs rather of continental and tropical towns than of towns in the United Kingdom. It is probably somewhat unfortunate that the first demonstration of the process in England, viz., that at Worthing early in 1894, was carried out on these lines, as it gave opponents occasion to remark with some show of truth that whatever the effect on the sewage might be, the introduction of the process on this system would require such a network of supply pipes, and necessitate such alterations to the sanitary arrangements of every house, that the cost and inconvenience would set the public against it.

The Hermite system has been too much considered as exclusively a system for conveying this antiseptic into the houses for flushing the closets with it, which is hardly a fair statement of the case. It is essentially a system for treating the sewage in the sewers as high up as it is found economical or advantageous to go; and it must be allowed that Dr. Ruffer has very properly pointed out that every town must be treated on its own merits. Where the sanitary arrangements of the houses are good, so far as modern science goes, and where the death-rate is comparatively low, financial prudence may dictate confining the application of the system to the main sewers and the branch sewers. On the other hand, where (as is the case with a large number of towns in tropical climates) the death-rate is extremely high and sanitary arrangements are very defective, and it is found that the authorities are justified in imposing upon the inhabitants a considerable outlay in order to bring the health of the town up to modern views of sanitation, then a complete system of carrying the solution into the houses should be insisted upon. Between these two there are various modifications. There is the consideration whether, in towns which limit the application of the system to the main and branch sewers, an exception should not be made in dealing with any insanitary areas or in dealing with hospitals; also, whether it is not wise to provide stand-pipes in different parts

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of the town, where the disinfectant supply can be obtained freely by all inhabitants requiring it, and the use of it made compulsory in visitations of epidemic. Numerous other modifications of the application of the system will suggest themselves to meet special cases.

In order more fully to set forth the method of working, and the results obtainable by the Hermite system, it may be interesting to give a few particulars of the work carried out at Ipswich, at Lytham, and at the Victoria Hospital, Netley.

Ipswich.—The Sewerage Committee of Ipswich being favourably impressed by what they saw of the system at Worthing, determined in the autumn of 1894, to put down a temporary installation to test the result of the process on a limited section of their sewerage system. After three months' run the County Analyst reported on it in very favourable terms. The Sewerage Committee followed up this report by urging strongly on the Town Council the permanent adoption of the process, at all events, on a scale sufficient to deodorize the main sewer and improve the outfall, both of which were sources of great annoyance from bad smells. The Borough Surveyor stated that nearly a thousand pounds had already been spent on ventilating shafts, and another thousand would certainly be required before the smells could be effectively dealt with. The adoption of the process would save this further outlay. It was unanimously resolved by the Council to put down an installation sufficient, at all events, to supply hermitine to the main sewer at the rate of one gramme chlorine per 24 hours per head of population. The outlay necessary for this was calculated at from £2,000 to £2,500, and the annual cost about £300 to £350, or say 1½d. per head of population per annum. The approval of the Local Government Board having been obtained and the site selected, the installation was erected and set to work in May, 1895, and has been at work daily ever since.

The plant consists of a compound engine giving about 30-brake h.p., a 4-pole dynamo giving a current of 600 amperes and 28 volts, 4 electrolysers placed in series and so arranged that the supply of sea water flows from one to the other, the electrolysis being completed at the discharge outlet of the lower one, a pump to draw the sea water from the docks three quarters of a mile away, and another centrifugal pump to force the electrolysed fluid through 600 yards of galvanized iron pipes to the point where it is discharged into the main sewer. The process is continuous, viz., the hermitine as fast as it is produced is delivered into the sewer and disinfects the sewage during its course through the town to the outfall works, two miles down the river Orwell, a point well known to steamboat

passengers up the Orwell by the bad smells. The amount of sea water drawn from the docks in the 24 hours approximates 26,000 gallons, or 1,100 gallons per hour, and the chlorine production is 2,400 grammes per hour, or say, 2¼ grammes per gallon or ½ gramme per litre. This is produced by an electrical expenditure of 600 amperes and 5 to 6 volts for each of the 4 electrolysers, so the yield in chlorine is 1 gramme per ampere hour. In fact it is somewhat above this, as the report of the County Analyst submitted after three months' run shows, his tests being taken daily for 30 consecutive days.

The effect of turning into the main sewer 26,000 gallons per diem of Hermitine of the above strength is very satisfactory. It must be borne in mind the amount is very small and did not pretend to be effective for sterilisation or other than effective deodorisation. The sewer throughout its length is free from smell, and samples taken at any point keep sweet for three or four days in the laboratory. The sewer is much cleaner, the slimy matter being broken up and washed away, and the effluent greatly improved. This last is attested by captains of steamers coming up the Orwell who assert that in no previous year has the condition of the Orwell near the outfall works been so satisfactory. And what is more significant is that the effects improve from week to week, showing that much of the hermitine has been absorbed by the mud deposits in the sewer, and as these get cleansed by its action, and the disinfectant exerts its full power on the daily flow of sewage, the effluent improves more and more. The result all round is considered very satisfactory by the Town Council, and it is contemplated to increase the plant and extend the distributing pipes so as to supply the solution to the higher parts of the branch sewers, and to allow of stand-pipes being erected at different parts of the town at which the disinfectant can be drawn off for flushing down any insanitary areas. This last is a very important feature of the system, for the cost of production does not exceed one penny per hundred gallons, so that it can be lavishly employed, and would no doubt be freely used for the disinfection of insanitary areas if provided free of charge.

In his paper read before the British Association in September last, Mr. Napier says:—

"I noticed in some of my early morning inspections, when the flow of sewage was at its minimum, that the deposit in the sewer was bleached nearly white by the action of the electrolysed solution. This process has not been going long enough to allow me to obtain any statistics as to the health of the Borough or the death-rate, compared with previous years and with other towns; but this I know that where the sewage has

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been treated no complaints have been received as to offensive smells. I am confident that any town that adopts this process, which will erect plant to produce enough of the electrolysed solution, will be spending money in the right direction, and in time will feel the benefit by increased health of the inhabitants and by having a lower death-rate. This is what I have suggested Ipswich should do, so that in a year or two, when we are able to make comparisons, we will find a reduction in the death-rate. Such a result will make the process cheap at any price."

Lytham.—The trial of the process at Lytham for four months last summer, presents several points of interest, which are dealt with in a very suggestive report, submitted to the Urban District Council by Dr. Jenkins, the Medical Officer of Health. Lytham has a population of 5,000, and the sewage has up to now been turned into the Liggard brook at two or three separate points, the highest of which is half-a-mile from where the brook runs into the Ribble. At the bridge on the Preston road are a pair of automatic tide gates, so that at high tide the sea water flows up to that point, the sewage delivered into the upper reaches of the brook being dammed back by these gates. At this point consequently there is always a great accumulation of sewage matter partly brought down from above the bridge and partly washed back from below by the incoming tide, and the smell arising from this is observable far and wide. When the tide is out all the upper part of the brook is bordered by evil smelling mud banks perfectly black. An analysis of this mud shows the greater part to be clay brought down the brook from higher up the stream and the clay and sewage accumulate to the depth of from one to two feet. Altogether it is a most dangerous and unsavoury condition of things to exist so near a town. Owing to the sewers of the town being in sections independent of one another it was found impracticable to deal with more than one of these sections. The plant was put down near the pier, a tank of sea water being there available. Each day some 10,000 to 12,000 gallons of hermitine were run into this section and three months run resulted in effecting a total disappearance of the bad smell at the bridge and a most decided improvement in the condition of the brook, and this result was attained in spite of a large amount of untreated sewage being sent into the brook all the time. Dr. Jenkins in his report states: "The probable conclusion would be that if the surface layer (which had been bleached to a grey colour) were constantly removed as soon as formed, the collection (of mud) would be rapidly disposed of." The running of the plant was stopped in September pending

the consideration of alterations to the outfall. Since the supply of hermitine has been stopped the brook has returned to its original condition both as regards the blackness of the deposits and the offensive foulness of the stream.

Dr. Jenkins made some interesting bacteriological investigations to determine the comparative microbicidal value of hermitine and other disinfectants, and gives hermitine the preferance by a long way as regards both cost and efficacy. His report concludes with a strong recommendation to the Council to put down the installation permanently. It remains to be seen if they will do so.

The Victoria Hospital, Netley.—This military hospital, situated on the shores of Southampton Waters, contains when the wards are full a population of some 1,500, staff and patients included. It consists of a large main building about 400 yards from the water and a considerable number of detached buildings in the rear. The plant is erected in a building close to the shore, and is capable of producing about 600 gallons per hour of hermitine. The solution is pumped from there into a tank at the top of the main building and thence distributed by pipes into all parts of the same and also into all the previously mentioned buildings in the rear. The supply pipes are connected with the closets and other sanitary arrangements, in fact hermitine is "laid on" through the whole buildings the same as the water supply. The capabilities of the plant are determined by the needs of a hospital which may at times be crowded with patients affected with infectious disease, and therefore the daily output is far greater than would be provided for a town. If worked the whole twenty-four hours an allowance per head of sixteen grammes of chlorine could be obtained, but it is expected that eight hours run per day will more than suffice for ordinary requirements. In this case then the plant is based on the *highest* scale of possible requirements just as that at Ipswich is based on the *lowest.* The installation has been recently started, therefore no data as to its efficiency are available.

All the above and similar cases involve the erection of a power station and a low tension dynamo. But it does not follow that hermitine cannot be produced except under these conditions. A useful modification of the electrolyser has been introduced, consisting of a battery of small electrolysers connected in series and workable with a direct current of 50 or 100 volts. The efficiency of these is far less than the ordinary type, and they are not recommended for large installations, but for isolated cases provided with direct current electric light plant

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such as steam ships, and many hospitals and factories, this modification is of great importance.

Such an apparatus was fitted on board a French troopship bound for Madagascar some six months since, and has given great satisfaction. Another is working in a Catholic school in Marseilles with excellent results, and there is a wide field for this type of electrolyser wherever electric light is installed on the direct current system.

The application of the Hermite system in towns provided with electric light and power stations deserves consideration as giving a "day load" for these stations. Even where the alternating system is employed, the same motive power, buildings and staff can be made use of, and the Hermite process consequently worked economically. As the steam power is not available during the whole of the 24 hours a somewhat larger plant has to be put down, but the saving in staff and expenses and stoker's wages, more than compensate for the extra cost of this.

Reference has been made hitherto to the use of the process for the sanitation of sea coast towns, but it must not be supposed that the cost of manufacturing artificial sea water would be so great as to make the system inapplicable to the sanitation of inland towns.

Moreover, many so-called inland towns are not so far distant from the sea coast as to render it economically impracticable to have sea water conveyed to them by pipes from the nearest point on the coast. Such a scheme is in contemplation for London, and a paper on the subject is to be read by Mr. Grierson before the Society of Arts. Mr. Grierson proposes to bring a supply of sea water from the South coast near Lancing, for the purpose of supplementing the fresh water supply of the Metropolis, the sea water to be used for street watering, baths, etc.

It is probable that if this scheme is carried out, the consumption of it for sanitation by the Hermite process will be equal to all other demands on it put together. And if such a scheme is feasible for London, it is equally so for Birmingham, Manchester and other inland towns.

MEETINGS HELD OCTOBER TO DECEMBER, 1895.

Sessional Meeting.

A meeting was held on December 11th, at 8 p.m., when a discussion was opened by Sir Douglas Galton, K.C.B., LL.D., F.R.S., on the lessons to be learned from the experimental investigations by the State Board of Health of Massachusetts on the Purification of Sewage. Sir Benjamin Baker, K.C.M.G., LL.D., F.R.S., in the chair. The following took part in the discussion: Mr. A. R. Binnie, M.Inst.C.E., Professor W. H. Corfield, Dr. Rideal, Mr. S. R. Lowcock, and others. About 90 Members, Associates, and Visitors attended. The paper and discussion will be published in Part I., Volume XVII.

Lectures and Demonstrations to Sanitary Officers.

The Twentieth Course of 24 Lectures and 15 Practical Demonstrations and Visits of Inspection to trade premises, Refuse and Sewage Disposal Works, &c., finished on November 22nd. 130 Students entered their names for this course.

Examinations.

Examinations for Inspectors of Nuisances.—These were held in the following towns:

London, December 6th and 7th. 128 candidates presented themselves, and 83 were certified to be competent as regards their sanitary knowledge to discharge the duties of Inspectors of Nuisances.

Cambridge, December 13th and 14th. 6 candidates presented themselves, and 6 were certified to be competent as regards their sanitary knowledge to discharge the duties of Inspectors of Nuisances.

Manchester, December 20th and 21st. 63 candidates presented themselves, and 33 were certified to be competent as regards their sanitary knowledge to discharge the duties of Inspectors of Nuisances. The Deputy-Chairman of The Sanitary Committee, and Dr. J. Niven, Medical Officer of Health, attended as Visitors.

Examination in Practical Sanitary Science.—London, December 6th and 7th. 22 candidates presented themselves and 10 candidates were granted Certificates in Practical Sanitary Science.

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FORTHCOMING MEETINGS.

Calendar, January to April, 1896.

As far as at present arranged.

Council Meetings are held Monthly on the Second Wednesday in each Month at 5 p.m.*

Finance Committee . . .	Second Wednesday at 4 p.m.
Exhibition Committee . . .	First Tuesday at 5 p.m.
Congress and Editing Committee .	Second Monday at 5.15 p.m.
Education Committee . . .	Third Monday at 5 p.m.
Museum and Library Committee .	Fourth Monday at 5 p.m.

* The Council Meeting in April will be held on April 15th.

JANUARY.

17 F. } 18 S. } Examination for Inspectors of Nuisances, Plymouth.

FEBRUARY.

12 W. Sessional Meeting at 8 p.m.; Discussion on "Influence of Sub-soil Water on Health," opened by S. Monckton Copeman, M.A., M.D., D.P.H.

17 M. Introductory Lecture to 21st Course of Lectures to Sanitary Officers, at 8 p.m., by Prof. A. Wynter Blyth, Barrister-at-Law, M.R.C.S., F.I.C., F.C.S.

20 T. Lecture to Sanitary Officers at 8 p.m. Sanitary Law; English, Scotch, and Irish, General Enactments; Public Health Act, 1875; Model By-Laws, &c., by Herbert Manley, M.A., M.B., D.P.H.

22 S. Inspection and Demonstration at Aylesbury Company's Dairy, Bayswater.

24 M. Lecture to Sanitary Officers at 8 p.m. The Law relating to the Supervision of Food Supply, by Prof. A. Wynter Blyth, Barrister-at-Law.

26 W. Inspection and Demonstration at St. George's, Hanover Square.

27 T. Lecture to Sanitary Officers at 8 p.m. Sanitary Laws and Regulations governing the Metropolis, by Prof. A. Wynter Blyth, Barrister-at-Law.

MARCH.

2 M. Lecture to Sanitary Officers at 8 p.m. Nature of Nuisances, including Nuisances the abatement of which is difficult, by Arthur Newsholme, M.D., D.P.H.

5 T. Lecture to Sanitary Officers at 8 p.m. Objects and Methods of Inspection, by J. F. J. Sykes, D.SC., M.D.

9 M. Lecture to Sanitary Officers at 8 p.m. Trade Nuisances, by Prof. A. Bostock Hill, M.D., D.P.H.

11 W. Sessional Meeting at 8 p.m.

12 T. Lecture to Sanitary Officers at 8 p.m. Water Supply, Drinking Water, Pollution of Water, by Prof. W. H. Corfield, M.A., M.D.(OXON).

16 M. Lecture to Sanitary Officers at 8 p.m. Infectious Diseases and Methods of Disinfection, by J. Priestley, B.A., M.D., D.P.H.

19 T. Lecture to Sanitary Officers at 8 p.m. Diseases of Animals in relation to Meat Supply; Characteristics of Vegetables, Fish, &c., unfit for Food, by Alfred Hill, M.D., F.R.S.E.

21 S. Inspection and Demonstration at Mitcham.

23 M. Lecture to Sanitary Officers at 8 p.m. Ventilation, Warming, and Lighting, by Louis C. Parkes, M.D., D.P.H.

25 W. **Ordinary General Meeting, 4 p.m.**
25 W. Inspection and Demonstration at St. George's, Hanover Square.
26 T. Lecture to Sanitary Officers at 8 p.m. Principles of calculating Areas, Cubic Space, &c.; Interpretations to Plans, and Sections to Scale, by J. Wallace Peggs, ASSOC.M.INST.C.E.
30 M. Lecture to Sanitary Officers at 8 p.m. Sanitary Building Construction, by Prof. T. Roger Smith, F.R.I.B.A.

APRIL.

3 F. *Good Friday.*
6 M. *Easter Monday.*
9 T. Lecture to Sanitary Officers at 8 p.m. Plumbers' Work, by J. Wright Clarke.
10 F. } 11 S. } Examination for Inspectors of Nuisances, Birmingham.
11 S. Inspection and Demonstration at the Beddington Sewage Farm, Croydon, conducted by Thomas Walker, M.INST.C.E.
13 M. Lecture to Sanitary Officers. Sanitary Appliances, by George Reid, M.D., D.P.H.
15 W. Sessional Meeting at 8 p.m. Inspection and Demonstration at East London Water Works, Lea Bridge, conducted by W. B. Bryan, M.INST.C.E.
16 T. Lecture to Sanitary Officers at 8 p.m. House Drainage, by W. C. Tyndale, ASSOC.M.INST.C.E.
18 S. Inspection and Demonstration at the Sewage Outfall Works, Barking, conducted by J. E. Worth, M.INST.C.E.
20 M. Lecture to Sanitary Officers at 8 p.m. Sewerage and Sewage Disposal, by Prof. H. Robinson, M.INST.C.E.
24 T. Lecture to Sanitary Officers at 8 p.m. Scavenging. Disposal of House Refuse, by C. Mason, ASSOC.M.INST.C.E., A.R.I.B.A.
25 S. Inspection and Demonstration at Sewage and Destructor Works, Ealing, conducted by C. Jones, M.INST.C.E.

FELLOWS, MEMBERS, AND ASSOCIATES ELECTED.

From October to December, 1895, inclusive.

FELLOWS (Fell. San. Inst.)

765 1895. Oct. Brown, Thomas, *King's Lynn, Norfolk.*
332 1895. Oct. Collingridge, William, M.A., M.D. Cantab, *Port of London Sanitary Offices, Greenwich, S.E.*
811 1895. Oct. King, Walter Gawen, M.B., C.M., D.P.H., *Disneys Gardens, Madras, India.*

MEMBERS (Mem. San. Inst.)

‡ Passed Examination as Inspector of Nuisances.

936 1895. Dec. Aitken, Thos., ASSOC.M.INST.C.E., *County Buildings, Cupar-Fife, N.B.*
925 1895. Dec. Armstrong, James G. D., *H. M. Office of Works, Tunbridge Wells, Kent.*
926 1895. Dec. Bennett, Clifton George, 6, *Sheffield Place, Mumbles, Glamorgan.*

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922 1895. Oct. Fraser, Andrew Mearns, M.B., C.M., D.P.H., 277, *Coldharbour Lane, Brixton, S.W.*

923 1895. Oct. ‡Goslett, Mrs. Clare, *Linden, Babbacombe, Devon.*

927 1895. Dec. ‡Greenwell, Allan, ASSOC.M.INST.C.E., *Surveyor, Blythe House, Frome, Somerset.*

937 1895. Dec. Harrison, James Herbert Hugh, M.O.H., *Orange Walk, British Honduras.*

928 1895. Dec. Hinton, James, *Chairman, Urban Sanitary Committee, Wiltshire County Council, Swindon.*

938 1895. Dec. Jenkin, Charles James, ASSOC.M.INST.C.E., ASSOC. M.INST.MECH.E., *Urban District Council Offices, Llandudno, N. Wales.*

929 1895. Dec. Legge, Thomas Monson, M.A., M.D., D.P.H., 13, *Portland Terrace, Regent's Park, N.W.*

939 1895. Dec. ‡McGraw, Hugh, M.S.A., 1, *Hornsey Lane, N.*

940 1895. Dec. Potts, William James, M.B., M.R.C.S., D.P.H., *Eastern Hospital, Homerton, N.E.*

930 1895. Dec. ‡Price, Arthur James, *City Engineer's Office, Guildhall, Worcester.*

931 1895. Dec. Priestley, Joseph, B.A., M.D., D.P.H., *Medical Officer of Health, Lambeth.*

935 1895. Dec. Rayner, Henry, M.D., *Upper Terrace House, Hampstead, N.W.*

941 1895. Dec. Reid, Arthur Henry, F.R.I.B.A., *P.O. Box* 746, *Johannesburg, South Africa.*

942 1895. Dec. Reynolds, Arthur R., *Ex-Commissioner of Health of Chicago, U.S.A.*, 36, *Washington Street, Chicago, U.S.A.*

924 1895. Oct. Spinks, William, ASSOC.M.INST.C.E., *Yorkshire College, Leeds.*

932 1895. Dec. Stephens, Lockhart Edward Walker, M.R.C.S., L.S.A., M.O.H., *The White House, Emsworth, Hants.*

943 1895. Dec. Tattersall, Charles Hermann, L.S.SC., M.O.H., *Town Hall, Oldham.*

933 1895. Dec. ‡Vallance, Hugh, M.R.C.S., D.P.H., *Meadvale, Surrey.*

934 1895. Dec. Willoughby, Joseph, 14, *Elmington Terrace, Plymouth.*

ASSOCIATES (Assoc. San. Inst.)

‡ Passed Examination as Inspector of Nuisances.

1192 1895. Oct. ‡Andrews, Stephen Hampton, *Whitelees House, Coalville, Leicester.*

1230 1895. Dec. ‡Banks, Joseph G., 13, *Victoria Avenue, Plashet Lane, East Ham.*

1220 1895. Dec. ‡Benstead, Frederick Winch, 11, *Mount Pleasant, Plumstead, S.E.*

1200 1895. Dec. ‡Blandford, Francis Robert, 97, *Donnington Gardens, Reading.*

1201 1895. Dec. ‡BOBBITT, Arthur Joseph, 91, *Glyn Road, Homerton, N.E.*
1193 1895. Oct. ‡BURCH, Ernest Arthur, 9, *Elizabeth Street, Eaton Square, S.W.*
1226 1895. Dec. ‡CALVERLEY, Thomas Winter, 46, *Richmond Road, Shepherd's Bush, W.*
1194 1895. Oct. ‡COATES, Nicholas, 5, *Waterloo Road, New Brighton, Cheshire.*
1219 1895. Dec. ‡COSSEY, John, *Church Grove, Loddon, Norwich.*
1195 1895. Oct. ‡COX, Frank Edward, *Sherborne, Springfield Road, Brighton.*
1222 1895. Dec. ‡DAWES, William Henry, *The Vagrant Wards, Crosland Moor, Huddersfield.*
1202 1895. Dec. ‡DUNSMORE, Horace, 67, *Brockley Rise, Forest Hill, S.E.*
1203 1895. Dec. ‡FIELD, Alfred John, 56, *St. Leonards Road, Bromley, E.*
1204 1895. Dec. ‡GRANT, Ernest William, 3, *Maria Street, Neath, Glamorgan.*
1205 1895. Dec. ‡GREENWOOD, James, 73, *Cambridge Street, Todmorden, Yorks.*
1225 1895. Dec. ‡GUDGIN, Harry Joseph, *Field View, Chapeltown, Sheffield.*
1206 1895. Dec. ‡HALLER, William Curtis, *Borough Sanitary Inspector, Keighley, Yorks.*
1207 1895. Dec. ‡HINDMARCH, John G., 50, *Hobart Terrace, Adswood Lane, Stockport.*
1216 1895. Dec. ‡HOWES, Thomas William, *Norfolk County Asylum, Thorpe.*
1223 1895. Dec. ‡IMMS, Henry Howard, 9, *Durham Road, Sparkhill, Birmingham.*
1231 1895. Dec. ‡KIRTON, Martin A., L.R.C.P., M.R.C.S., 7, *Clarendon Terrace, Stoke Damerell, Devonport.*
1217 1895. Dec. ‡LLOYD, Charles B. W., 51, *Chewton Road, Walthamstow.*
1221 1895. Dec. ‡MACADAM, Charles Bernard, *University College, Bangor, N. Wales.*
1227 1895. Dec. ‡MARSHALL, John, *High Street, West Malling, Kent.*
1232 1895. Dec. ‡MCMILLAN, Miss Rachel, 12, *Endsleigh Gardens, N.W.*
1196 1895. Oct. ‡MORRISON, George William, 20, *Rumsey Road, Stockwell, S.W.*
1208 1895. Dec. ‡OFFER, Albert James, *Handcross, Crawley, Sussex.*
1220 1895. Dec. ‡PARFITT, Clifford J., *Maindee, Newport, Mon.*
1209 1895. Dec. ‡RAMSCAR, William, 24, *New Zealand Road, Stockport.*
1214 1895. Dec. ‡READ, Frank, 6, *Pottergate Street, Norwich.*
1215 1895. Dec. ‡RICHFORD, James William, *Wells-next-the-Sea, Norfolk.*
1228 1895. Dec. ‡ROGERS, George, 2, *Manley Road, Newport, Mon.*
1197 1895. Oct. ‡ROSS, Douglas, *Town Hall, Hastings.*

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1218 1895. Dec. ‡Sampson, Edward Arthur, *Beauchief Abbey, Sheffield.*
1210 1895. Dec. ‡Scrivener, John Charles, *Royal Kentish Buildings, Tunbridge Wells.*
1211 1895. Dec. ‡Shail, Albert, 1, *Richmond Villas, Talbot Road, Isleworth, W.*
1212 1895. Dec. ‡Smith, C. Cuthbert, *Bilton House, Rugby Road, Leamington, Warwick.*
1213 1895. Dec. ‡Turner, Edward William, 184, *Wellington Street, Grimsby.*
1196 1895. Oct. ‡Whalley, Miss Margaret, 3, *Ye Meads, Taplow.*
1199 1895. Oct. ‡Whieldon, Edmund, *Ivy Villa, Southampton Road, Eastleigh, Hants.*
1221 1895. Dec. ‡Whipp, John W., *Charles Street, York.*

OBITUARY.

DIRECTOR-GENERAL SIR THOMAS CRAWFORD, K.C.B., Q.H.S., M.D., LL.D., *a Vice-President, Fellow, and Past Chairman of Council.*

The Sanitary Institute has sustained a severe loss by the death of Sir Thomas Crawford, which took place at his residence, 5, St. John's Park, Blackheath, early in the morning of Saturday the 12th October. He had been in failing health for some time, but no one expected that his valued life would have been brought to a close so soon.

A son of the late Mr. Joseph Crawford, of Dumbrain, Co. Monaghan, he was born on 1st March, 1824, and was educated in Edinburgh University, where he graduated M.D. in 1848; he was admitted Licentiate of the Royal College of Surgeons of Edinburgh in 1845. He was an Honorary Fellow of the King and Queen's Royal College of Physicians, and of the Royal College of Surgeons; Master in Surgery of the Royal University of Ireland; and Honorary LL.D. of Edinburgh. He was for some time President of the Senate of the Army Medical School at Netley, and in October, 1886, was gazetted Honorary Surgeon to Her Majesty the Queen.

Before his association with the Institute he had a distinguished career in the Army Medical Service, which he entered as Assistant-Surgeon on the 18th February, 1848; he

became Surgeon in 1855; Surgeon-Major in 1868; Deputy Inspector-General in 1870; Deputy Surgeon-General in 1873; Surgeon-General, 5th Dec., 1876; Director-General 1882 to 1889; and on the 7th of May in the latter year was put on retired pay.

He had much foreign service. In 1852 and 1853 in the Burmese war with the old 51st Light Infantry, and was present in many engagements, for which he received the Burmese medal and clasp for Pegu; with the 18th Royal Irish he took part in the Crimean campaign, from February, 1855, to the fall of Sebastopol. He was mentioned in Despatches, and received the Crimean medal, with clasp for Sebastopol, and the Turkish medal.

He served in the Indian mutiny as Principal Medical Officer to the Southern India Field Force in the Northern Mahratta country and Deccan in 1857 and 1858. Returning thence, he was appointed by selection, head of the Medical branch of the Director-General's office in London, until ordered again to India as Superintending Surgeon of the Sirhind circle in Bengal. Coming home once more, in 1877 he was appointed Principal Medical Officer in Ireland, serving till 1879, when he was again sent to India as Principal Medical Officer in Madras, and Principal Medical Officer in Bengal from 1880, when he served in the second Afghan war—and was again mentioned in Despatches, and thanked in General Orders by the Commander-in-Chief and the Governor-General in Council—until 1882, when he was recalled, and succeeded Sir William Muir, G.C.B., at Head-Quarters as Director-General of the Army Medical Staff. He was created K.C.B. 25th August, 1885.

His association with the Institute began in December, 1883, when he became a Member of the Parkes Museum, and joined the Council in 1885, becoming a Fellow of The Sanitary Institute on the Incorporation in 1888, by the amalgamation of the Parkes Museum with the Sanitary Institute of Great Britain. He was elected Member of Council of the new body, served on several important committees, and took great interest in the advancement and the well-being of the combined Societies. He was Chairman of the Finance Committee from June, 1891, to June, 1892, was elected Chairman of Council in April, 1892, in succession to Sir Douglas Galton, K.C.B., and unanimously re-elected in 1893, and thus served the full period provided by the Articles of Association. He then as Member of Council, and after his election as Vice-President in March, 1895, constantly attended both Council and Committee meetings, and took a keen interest in the work of the Institute.

While Chairman of Council, Sir Thomas Crawford gave full

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proof of those qualities which had earned for him elsewhere universal popularity.

His noble presence and his charm of manner, as well as his complete mastery of detail and calm sound decisions on important subjects, fitted him in every sense as a leader; he was one of those rare beings whom to see is to admire, and to know is to love; gifted with exceptional ability, he was ever considerate and affable to those about him, and always ready with his vast experience and sound common sense when wanted; he made friends wherever he went.

We shall not soon forget his Presidency over the Brighton Congress—one of the most successful the Institute has known—in 1890; a glance over his Presidential Address will show the dominant principle in the mind of the man, and the last word "PURITY" the key-note of his life: the same tone pervaded his much appreciated address to the Congress at Portsmouth in 1892, on "English Homes."

Sir Thomas was conspicuous as a frequent attendant at other than Council Meetings of the Institute; he took part in its discussions and contributed to its literature. His last address was delivered at the reception given by the Council to the Members of the British Medical Association, on 30th July, 1895, "On the Position of Medical Officers of Health in regard to the administration and working of the Infectious Diseases Notification Act."

No man more nearly embodied the ideal of Longfellow's "Psalm of Life"; his whole existence seemed to be for others, unmindful of himself.

He will be missed too at "The Gordon Boys' Home," and at "The Royal School for Officers' Daughters of the Army" at Bath. He was Member of the Governing Body in both Societies, and Chairman of the latter, succeeding the late General Philip Ravenhill, C.B., R.E., and he took a lively interest in both institutions, and an active part in their management; nor was he less devoted to subjects in the district in which his last years were spent, and where he was buried on the 15th October.

He has passed "within the veil"—respected, beloved, mourned, by "troops of friends"—"Till the day break and the shadows flee away."

LAMOROCK FLOWER.

NOTE.—A Portrait of Sir Thomas Crawford faces page 429.

EXHIBITS ADDED TO THE MUSEUM.

SEPTEMBER—DECEMBER, 1895.

DIVISION A.

Science in Relation to Hygiene.

Lantern Slides. Subjects: Ellison's Air Brick. Tobin's Tube. Sherringham's Valve. Mica Flap Ventilator. Hinckes Bird's Window. Fans and Blowers. Interior of an ordinary room with temperatures indicated at various points. Interior of same room with a Ventilating Grate and Outlet Ventilator fixed. Section of House showing method of fixing Ventilating Grates and Outlet Flues. Bond's Euthermic Gas Stove. George's Calorigen. Convoluted Stove. Fixed Cowls. Movable Cowls. Hot Water Circulating Systems, including Tank and Cylinder Systems. Air Motors, including Water Spray and Gas Burners. Ventilating Gas Burners. Outside Air Spaces in relation to blocks of houses. Diagramatic representation of Building angle of 63·5 degrees. Pasteur-Germ Filter. Berkefeld Filters. *Purchased.*

Diagrams, including three Specimens of Ordnance Survey Maps. Three illustrating ordinary Surveying work. Metric System. Signs and Symbols (Arithmetical). English Standards. *C. H. Cooper, Assoc.M.Inst.C.E.*

DIVISION C.

Construction and Sanitary Apparatus.

Sewage Purification. A Photograph of a Model Filter and Precipitating Tank, as exhibited in working order at the Liverpool Exhibition. *The Sewage and Water Effluent Filtration Co., Ltd.*

Column Flushing Cistern, Siphon action, two gallons. McCormick's Patent. *J. Tylor & Sons.*

Bib-Cock and Safety Valve Combined, for the prevention of explosions in kitchen or circulating boilers. *Chas. Nichols & Sons.*

Fur from kitchen boilers. *J. Foxley Norris.*

DIVISION D.

Personal and Domestic Hygiene.

Liver Fluke. Specimen of Sheep's Liver, with Flukes in Bile Ducts. *Dr. A. Newsholme.*

CONTRIBUTIONS AND ADDITIONS TO LIBRARY,

OCTOBER TO DECEMBER, 1895.

*** *For publications of Societies and Institutions, &c., see under "Academies."*

ACADEMIES (BRITISH).

Edinburgh. Medical School Calendar and Guide to Students. 1895-96. 359 pp., 8vo. Edinburgh. *E. & S. Livingstone.*

Glasgow. *The Institution of Engineers and Shipbuilders in Scotland.* Transactions, Vol. XXXVIII., 1894-95. 402 pp., 8vo. Glasgow, 1895. *The Institution.*

London. *City of London College.* Calendar for 1895-96. 191 pp., 8vo. London, 1895. *The College.*

——— *Incorporated Association of Municipal and County Engineers.* Proceedings, Vol. XXI. 1894-95. 330 pp., 8vo. London, 1895. *The Association.*

——— *Institution of Civil Engineers*, Subject Index to Minutes of Proceedings. Vols. LIX. to CXVIII. Sessions 1879-80 to 1893-94. 533 pp., 8vo. London, 1895. *The Institution.*

——— *Royal College of Surgeons of England.* Calendar, 1895. 330 pp., 8vo. London, 1895. *The College.*

——— *University College.* Calendar, Session 1895-96. 463 pp., 8vo. London, 1895. *The College.*

Board of Agriculture. Agricultural Returns. Statistical Tables showing acreage under crops and grass, number of horses, cattle, sheep and pigs in the United Kingdom; with particulars of each county of Great Britain. 39 pp., 8vo. London, 1895. *The Board.*

Calcutta. Cholera in Calcutta in 1894, and anti-choleraic inoculation. 12 pp., f.cap. Reprinted from the Health Officer's Annual Report for 1894. *Dr. W. J. Simpson.*

Chemistry. Catechism Series. Part I., Inorganic; 63 pp. Part II., Inorganic and Organic; 64 pp., 8vo. Edinburgh, 1892. *E. & S. Livingstone.*

Corfield, *Prof. W. H., M.A., M.D.Oxon.* The Laws of Health. (The London Science Class-books.) 153 pp., 8vo. London, 1892. *The Author.*

Davies, *E. Plummer.* Paper on the Sanitation of the Farm. 8 pp., 4to. Newport, 1895. *The Author.*

Day, *Charles Aubrey.* The Complete Handbook on British, Colonial,

and Foreign Patents, Trade Marks, and Designs. 40 pp., 8vo. London, 1895. *The Author.*

England and Wales. Census, 1891. Vol. I., Area, Houses and Population; Administrative and Ancient Counties. Vol. II., Ditto; Registration Areas and Sanitary Districts. Vol. III., Ages, Conditions as to Marriage, Occupations, Birth-places, and Infirmities. Vol. IV., General Report; the Summary Tables and Appendices and Index to the Population Tables of England and Wales. 5 Vols. Folio. London, 1895. *Dr. J. W. Tatham.*

Factory and Workshops Act, 1895. 24 pp., 4to. London, 1895. *Purchased.*

Fisher, *W. W., M.A., F.C.S.* A Class-book of Elementary Chemistry. 2nd Edition. Clarendon Press Series. 272 pp., 8vo. Oxford, 1894. *Oxford University Press.*

Glen, *R. Cunningham, M.A., LL.B., and* **Bethune,** *Arthur A., Barrister-at-Law.* The Law Regulating Streets and Buildings in the Metropolis under the London Building Act, 1894, and other Metropolitan Statutes; together with the Standing Orders, Regulations, Bye-laws, Forms, &c., of the London County Council and of the Commissioners of Sewers of the City of London; with Explanatory Diagrams by **Conder,** *Alfred, F.R.I.B.A.* 682 pp., 8vo. London, 1895. *Knight & Co.*

Greenwell, *Allan, A.M.I.C.E., and* **Curry,** *W. T., A.M.I.C.E.* Rural Water Supply; a practical handbook on the Supply of Water and Construction of Waterworks for small country districts. 210 pp., 8vo. London, 1895. *Allan Greenwell.*

Greville, *H. Leicester, F.I.C., F.C.S.* The Student's Handbook of Chemistry; with Tables and Chemical Calculations (2nd edition.) 488 pp., 8vo. Edinburgh, 1887. *E. & S. Livingstone.*

Jago, *William, F.I.C., F.C.S.* Inorganic Chemistry, Theoretical and Practical. Longmans' Elementary Science Manuals (14th edition). 347 pp., 8vo. London, 1894. *Longmans, Green & Co.*

Leighton, *John, F.S.A.* The Unification of London. 64 pp., 8vo. London, 1895. *The Author.*

Local Government Board. Dr. H. W. E. Fletcher's Report on the Sanitary circumstances of the Thurmaston Urban District. 4 pp., f.cap. London, 1895.

——— Dr. S. Monckton Copeman's Report on an Outbreak of Enteric Fever at Loddon, in the Rural District of Loddon and Clavering. 12 pp., f.cap. London, 1895.

——— Dr. R. J. Reece's Report on an Outbreak of Diphtheria, and on certain cases of "Pneumonia" in the Borough of Flint. 12 pp., f.cap. London, 1895.

——— Dr. S. W. Wheaton's Report on the Sanitary condition of the Borough of Chipping Wycombe, and on the Prevalence of Enteric Fever in that Urban District. 6 pp., f.cap. London, 1895. *Dr. R. Thorne Thorne.*

Macmorran, *Alexander, M.A.* The Public Health (London) Act, 1891. 306 pp., 8vo. London, 1891. *Shaw & Sons.*

Martin, *James W., M.D.* Yellow Fever; a Monograph. 56 pp., 8vo. Edinburgh, 1891. *E. & S. Livingstone.*

MEDICAL OFFICERS OF HEALTH AND OTHER SANITARY REPORTS.

Calcutta, 1894 .. .. *Dr. W. J. Simpson.*
Kensington, 1894 .. .. *Dr. T. Orme Dudfield.*
Lancaster, C. C., 1894 .. .. .. *Dr. E. Sergeant.*
St. George's, Hanover Square, 1894 .. *Prof. W. H. Corfield.*
St. Pancras, 1894 .. .. *Dr. J. F. J. Sykes.*

Mitchell, *Charles F.* Building Construction and Drawing. First Stage or Elementary Course (3rd edition). 272 pp., 8vo. London, 1894. *B. T. Batsford.*

Mitchell, *Charles F.*, assisted by **Mitchell,** *George A.* Building Construction. Advanced and Honours Courses. 506 pp., 8vo. London, 1894. *B. T. Batsford.*

Mullins, *George Lane, M.A., M.D.* Notes on Phthisis in New South Wales and other Australasian Colonies. 14 pp., 4to. Reprint from the "Australian Medical Gazette." *The Author.*

Paris. Relation officielle de la cérémonie d'inauguration des Travaux de l'aqueduc d'Achères. 24 pp., 4to. Paris, 1895. *George Bechmann.*

Paris, Ville de. Aqueduc d'Achères. Note sur l'execution des Travaux. 11 pp., 8vo. Paris, 1895. *George Bechmann.*

Public Health. Catechism Series. Part I., Water, 56 pp.; II., Air and Ventilation, 59 pp.; III., Sewage, 56 pp.; IV., Vital Statistics, 56 pp.; V., Medicine, Food, Burial, Water Closets, Disinfectants, Warming, and Hospitals, 56 pp. 8vo. Edinburgh, 1890-91. *E. and S. Livingstone.*

Registrar-General *(Ireland).* Thirty-first detailed Annual Report, containing a general Abstract of the number of Marriages, Births and Deaths registered in Ireland during the year 1894. 197 pp., f.cap. Dublin, 1895. *Dr. T. W. Grimshaw.*

Rideal, *S., D.Sc., F.I.C., F.C.S.* Disinfection and Disinfectants, an Introduction to the study of; together with an account of the chemical substances used as antiseptics and preservatives. 32 pp., 8vo. London, 1895. *The Author.*

Roscoe, *Sir Henry, LL.D., F.R.S.* Lessons in Elementary Chemistry, Inorganic and Organic (5th edition). 503 pp., 8vo. London, 1894. *Macmillan & Co.*

Roscoe, *Sir Henry, LL.D., F.R.S.*, assisted by **Lunt,** *Joseph, B.Sc., F.C.S.* Inorganic Chemistry for Beginners. 254 pp., 8vo. London, 1895. *Macmillan & Co.*

Savage. *E. B., Assoc.M.Inst.C.E.* Sewerage and Sewage Disposal of a Small Town. 83 pp., 8vo. Plates. London, 1895. *The Author.*

School of Military Engineering. Notes on Warming Buildings for Class Instruction. 108 pp., 8vo. Chatham, 1895. *Major G. K. Scott Moncrieff.*

Stewart, *Balfour, M.A., LL.D., F.R.S.* Lessons in Elementary Physics (5th edition). 475 pp., 8vo. London, 1895. *Macmillan & Co.*

Switzerland. Mariages, Naissances et Décés en Suisse de 1871 à 1890. Première Partie, Mariages Contractés et Mariages Dissous. 75 pp., 4to. Berne, 1895. *Bureau de Statistique*

Tallack, *William.* Penological and Preventive Principles, with special reference to Europe and America. Second Edition. 480 pp., 8vo. London, 1895. *The Howard Association.*

Waring, *Geo. E., Junr., M.Inst.C.E.* The Purification of Sewage by forced Aëration. Report on an Experimental Investigation of the value of a process for Purifying Sewage by means of Artificially Aërated Bacterial Filters. 67 pp., 8vo. Newport, U.S.A., 1895. *The Author.*

Woollcombe. *W. G., M.A., B.Sc.* Practical Work in General Physics. 83 pp., 8vo. Oxford, 1894. *Oxford University Press.*

Wright, *Mark R.* Elementary Physics (5th edition). Longmans' Elementary Science Manuals. 260 pp., 8vo. London, 1894. *Longmans, Green & Co.*

THE FOLLOWING JOURNALS AND PERIODICALS HAVE BEEN RECEIVED DURING 1895.

Weekly.

British Architect.
British Medical Journal.
Builder.
Contract Journal.
County Council Times.
Food and Sanitation.
Illustrated Carpenter and Builder.
Indian Engineering.
Industries and Iron.
Journal d'Hygiène.
Journal of the Society of Arts.
Local Government Chronicle.
Local Government Journal.
Nursing Record.
Surveyor.
The Sanitary Record.
Veterinary Record.

Monthly.

Health Messenger.
Ironmongery.
Journal of the Royal Institute of British Architects.
Journal of Society of Chemical Industry.
Journal of the Sanitary Inspectors' Association.
Medical Magazine.
Meteorological Record.
Plumber and Decorator.
Public Health.
Sanitarian, New York.
Sanitation in the West.
Sei-i-Kwai Medical Journal.
Zdrowie.

Quarterly.

American Society of Civil Engineers' Proceedings.
Deutsche Vierteljahrsschrift für öffentliche Gesundheitspflege.
Journal of the American Public Health Association.
Journal of the Royal Meteorological Society.
Journal of the Royal Statistical Society.
North of England Institute of Mining and Mechanical Engineers' Transactions.
Proceedings of the Society for the Study of Inebriety.
Quarterly Record of the Royal Botanic Society of London.
Registrar-General's Returns. England and Wales; Scotland and Ireland. Weekly, Monthly, and Quarterly.
Technology Quarterly and Proceedings of the Society of Arts (Massachusetts).
The Surveyors' Institution Transactions.

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NOTES ON LEGISLATION AND LAW CASES.

Prepared by Prof. A. Wynter Blyth, Barrister-at-Law.

COURT OF APPEAL.

Before the MASTER OF THE ROLLS (Lord Esher), LORDS JUSTICES KAY AND SMITH.

SARSON *v.* ROBERTS (83 *L. T.*, n. s. 174.)

There is no implied condition on letting furnished lodgings that the premises shall continue to be fit for occupation during the whole term, and there is no duty on the landlord to inform his tenant of anything that happens during the term to make the premises unfit for occupation.

The chief facts of the case are as follows:

The Defendant let furnished lodgings, and the Plaintiff, with his wife and children, took these lodgings, the Defendant himself living in the same house, and providing the necessary attendance. During the Plaintiff's occupation a grandchild of the Defendant became ill with scarlet fever in the same house and continued there, but the Defendant did not inform the Plaintiff of the fact. Soon after the Plaintiff left the Defendant's house and returned home, his wife and one of his children became affected with scarlet fever. The Plaintiff brought an action for damages, which was heard before Mr. Commissioner Chalmers and a Jury. The Jury found that the premises were healthy at the time of the letting, but they became unhealthy during the tenancy of the Plaintiff, that the Defendant concealed from the Plaintiff the fact of there being infectious disease in the house, and that the Plaintiff's wife and child contracted scarlet fever from the Defendant's lodgings. The Jury assessed damages, and the learned Commissioner gave judgment for the Plaintiff for the amount of damages assessed by the Jury.

The Defendant appealed.

The Counsel for the Appellant, F. Marshall, Q.C., and W. B. Bates, referred to Smith *v.* Marrable, 11 M. and W. *5*; Wilson *v.* Finch Hatton, 36 *L. T.* Rep., 473 *L.* Rep., 2 Ex. D. 336, and argued that in Maclean *v.* Currie (I. C, and E. 361) Justice Stephen laid it down that on the letting of a furnished house there is not any implied condition that it shall continue to be habitable during the term.

E. H. Lloyd, for the Respondent, argued that there is an implied condition that the premises shall continue to be habitable during the term. In Wilson *v.* Hatton, Kelly, C. B., says: "I now therefore hold that it is an implied condition in all hirings of a furnished

house that the house shall be in good and tenantable condition, reasonably fit for human habitation, and for comfortable habitation, and from the very day on which the tenant is to enter down to the very day on which the tenancy is to cease, otherwise he has not what he contracted for."

MASTER OF THE ROLLS (Lord Esher): We are asked in this case to imply a condition or a duty into a contract where there is none expressed. The only ground upon which a condition can be implied is, that the condition must be necessary to the carrying out of the contract in the view of both parties. Can we say in this case that both parties to such a contract as this contemplated that such a duty or condition should be implied? It was at first argued that a condition must be implied that the house should be in a sanitary condition at the time of entry, and should so continue throughout the period of letting, so that if it became insanitary during the tenancy the tenant would have a right to rescind the contract, and to refuse to pay the agreed rent, being liable for use and occupation only. I see no ground for implying any such condition. Then the duty was stated to arise upon a further ground, not merely from the relationship of landlord and tenant, but from the making of such an agreement as was made in this case. How is it possible to imply, from the stipulations of this agreement, a condition that the house shall be sanitary during the tenancy? We cannot imply this duty or condition; the judgment of the learned Commissioner is wrong, and the appeal must be allowed.

LORD JUSTICE KAY: There is no case where such a condition has been implied, and I do not wish to add to the cases in which conditions are implied. The cases have gone as far as this: where a man hires a furnished house or lodgings, there is an implied condition that when they are hired they are reasonably fit for the purpose for which they are hired. That is because the landlord, knowing the purpose for which they are hired, must be understood to agree to be bound by a condition that the thing which is let is reasonably fit for the purpose for which it is let. To carry that rule further, and to say that it extends so far as to be a warranty that the premises shall be sanitary, and remain in that condition during the tenancy, would be most unreasonable. With respect to the condition which is implied, it is entirely independent of the knowledge of the landlord, and it is no excuse for the landlord to say that he did not know that the premises were insanitary. To say that the condition applied to the case where the premises become insanitary after the tenant has entered would be unreasonable. The landlord has no power to prevent that happening. If the condition were as wide as that, the tenant could then, though the landlord was not to blame, at once throw up his contract. It would in my opinion be exceedingly unreasonable to imply such a condition. The rule which does exist is extremely artificial, because it does not apply in the case of an unfurnished house, in which case the landlord is not bound by any such condition. I am not inclined to extend the condition beyond that which was

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implied in Smith *v.* Marrable. That case is not applicable to one like this. Another point has been argued. It is said that even supposing that such a condition cannot be implied, yet there is a duty on the landlord, when there is sickness in the house, to communicate that fact to the lodger. Was there any such legal duty? From what could such duty arise? It could not arise from the mere relationship of landlord and tenant that there is such a duty.

LORD JUSTICE SMITH delivered judgment to the like effect.

Appeal allowed.

SUPREME COURT OF JUDICATURE.

Before the MASTER OF THE ROLLS (Lord Esher), LORDS JUSTICES KAY AND SMITH.

KERSHAW *v.* TAYLOR.

(*L. T. Rep.* xxiii., 274.)

On appeal from the Queen's Bench Division.

A district board sanctioned the construction of a combined drain for two houses, but the building owner improperly connected four instead of two houses to the sewer by one drain. Held that the drain was a sewer within the meaning of the Met. Man. Act, 1855.

The essential facts of this case are set forth in the judgment of the Court as follows:—

The MASTER OF THE ROLLS (Lord Esher): In this case the owner of a house has been required by the Sanitary Authority to do certain drainage works on his premises, which works he has refused to do. The house in question together with five others was built by a man named Gatfield in 1887. Before building these houses he sent in to the District Board a plan showing the system of drainage which he proposed in respect to them. The Board passed a resolution that the proposed plan might be carried out subject to the work being executed to the satisfaction of the surveyor. Gatfield thereupon proceeded to build the houses, but instead of following the plan which had been sanctioned by the Board, according to which the drainage of each pair of houses was to be carried by a separate drain into the sewer, he makes a single drain serve for draining four of the houses. It follows that the surveyor of the Board did not go to see if the work was done to his satisfaction. It has been argued that as the work could not be constantly under his supervision he could not test whether it was done to his satisfaction, and that any expression of such satisfaction on his part must be purely formal. I do not accept that suggestion. In my opinion, if the surveyor had gone to see whether the work had been properly carried out he would have ascertained that it had not been. But he did not go. Those being the facts and the Act providing that any drain which drains more than one building, unless under the order of the District Board, is a sewer, it is clear that Gatfield, by what he did, in fact, constituted this receptacle for drainage a sewer within that definition.

Therefore, if as against the defendant the only question is what this thing is, in fact within the meaning of the Act of Parliament, the summons against the defendant was rightly dismissed. The defendant's position is that as owner of a house he was called upon to remedy defects in its drainage. He proceeded to do so but upon examining that which he was required to repair he finds that it drains three other houses besides his own; that it is in fact therefore a sewer which he is not bound to repair, and he therefore declines to continue the work. What ground is there for saying there is any estoppel as against him which prevents his asserting as the fact is that this is a sewer? He had not done anything wrong in the matter. In my opinion all we have to do is to say that this is a sewer within the definition in the Act. The circumstance that the man who built the house did not do what he was told to do appears to me to be altogether immaterial in this case. The defendant is responsible for nothing that happened with regard to the original execution of the drainage works when the house was built, he finds that it has been so constructed as to be a sewer and not a drain and he is therefore not liable to make good any defects in it. This is not the least like a case which was put in argument of a stranger to the board interfering with a drain and connecting it with the drains of other houses without the knowledge of anyone. That state of things would raise a question which we have not to decide on the present occasion. In this case the district board knew that the work was going to be done and it was only by their negligence that Gatfield was enabled to depart from the sanctioned plan. The judgment of the Divisional Court was right and the appeal must be dismissed.

Lord Justices Kay and Smith concurred.

Appeal dismissed.

THE POWER OF ENTRY UNDER THE PUBLIC HEALTH (LONDON) ACT, 1891.

The power of entry in cases where there is no real ground of complaint, and no allegation or complaint of nuisance has been raised in a London Police court. A vestryman having refused to allow the Sanitary Inspector to inspect his premises.

It has always appeared to the writer that since the passing of the Public Health (London) Act, 1891, the most extensive powers have been given to the officers of Local Authorities in the Metropolis to inspect premises generally. Not only is the power given but a duty has been created, the 1st Sect. clearly stating that, "It shall be the duty of every sanitary authority to cause to be made from time to time inspection of their district."

The express power of entry is given under Sect. 10, which states, "The sanitary authority shall have a right to enter from time to time any premises," for the purpose of detecting nuisances, or seeing whether works ordered have been completed, or for similar purposes. This power of inspection is not really new, for it has existed as

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applicable to the special case of drainage since 1855, the 82nd Sect· of the Metropolitan Management Act (18 & 19 Vict. c. 120), giving a power of entry to inspect drains and even open the ground after twenty-four hours' notice, or in case of emergency without notice.

In the Police Court case alluded to Mr. Walter Florey, a member of the Vestry and also a member of the Sanitary Committee of Stoke Newington, refused admission to the Sanitary Inspector, and the Vestry promptly summoned him and obtained a conviction with a penalty. The Defendant contended that when admission was refused the Inspector should have applied to a magistrate for an order for admission. This is certainly the usual course, however, the magistrate pointed out the refusal was an obstruction, and the act of refusing admittance involved a penalty.

This case has served a useful purpose in bringing home to the public generally the state of the law. On the other hand Sanitary Officers are bound to use such large powers with great discretion.

GENERAL NOTES.

THE PORT OF LONDON.—The forty-fourth report of Dr. W. Collingridge, the Medical Officer of Health for the Port of London, for the half-year ended June 30 last, published in October, shows that 12,715 vessels have been inspected during this period, being a large increase on former returns. This gives an average of three for every working day. It is suggested that plans of new vessels should be submitted to the Port Sanitary Authority, in the same way that plans of new houses are submitted to local authorities. The visit of a medical officer in conjunction with Her Majesty's Customs at Gravesend is continued and works satisfactorily; 4,249 vessels having been visited, 1,094 being specially inspected, this involving the examination of 24,000 persons. The result has been the removal at Gravesend of twenty-seven cases of infectious disease. With regard to cholera and choleraic diarrhœa no fewer than fifty-three cases were reported as having occurred on vessels arriving in London. Previous to the adoption of this system, the half-yearly average amounted only to 3·3 cases; this has risen during the last three years during which medical inspection has been carried out to 13 per half-year—which is considered proof of the value of the system as a safeguard against the importation of disease. A medical officer is also stationed at Sheerness, the cost of this arrangement being borne by London and Rochester conjointly.

"THE EVILS OF BAD CHURCH VENTILATION.—To those who are not in perfect health, few things are more calculated to give rise to any malady to which they may have a tendency than sitting in a chilly church after the sharp walk which the ineradicable tendency to starting late seems to impose on all churchgoers. Perhaps the worst error in warming churches is committed by those who put off the commencement of the process until Saturday night, or may be Sunday morning, and then fire up hard to get things ready for 11

o'clock. The windows are kept closed for fear of losing heat; the stagnant air, with which those who visit churches on the week-day are so familiar, is warmed up for Sunday use, but the walls remain cold, and when service commences hot and even burnt as the air may feel, there is no warmth in the building. Worshippers are thus subjected to the worst possible combination of surroundings—bad ventilation, foul atmosphere, draughts from internal currents, and the respiration of hot air while sitting in a building which is cold. The problem is not how to warm the air alone, but how to warm the church itself. This is necessarily a slow process, and it is doubly slow where, as is commonly the case, the attempt is made to use the same apparatus to warm the church as is employed to warm the incoming air. Unless, as in some cathedrals, stoves are placed actually within the church so that radiant heat is available, we doubt whether it is possible in cold weather to make a building fit for Sunday use without keeping up the fire all the week. This is not so much a matter of coals as of labour and supervision. A little fire all the week, with only just enough ventilation to keep the air sweet, will do far more to make the fabric warm than a great blaze for a few hours; and after all, what is wanted much more is to warm the fabric, so that every stick and stone shall radiate a sense of comfort. When churches are too hot from over-firing, people catch cold in consequence of the draughts which are produced, and from the chill on coming out again. These are what one may call honest colds—stiff necks, neuralgias, lumbagos, and sometimes "cold in the head"—things they might catch anywhere from sitting in a draught even of pure air. Unfortunately, too often the heat is the heat of closeness rather than of excess of fire, and then the results are much more deadly. Added to the evil of the draughts are the toxic effects of breathing again the breath of others, and absorbing the exhalations of their fellow worshippers. From such influences arise too often those depressing colds which, in fact, were till 1889 called "influenza colds," with streaming eyes and nose, feverishness, and depression, drifting sometimes into an almost suppurative post-nasal catarrh, with great exhaustion."—*British Medical Journal.*

A Special Notice, issued on December 21st by H.M. Chief Inspector of Factories, calls attention to certain requirements of the Factory and Workshop Acts, among which is noted the following relating to Infectious Diseases: "If any occupier of a factory or workshop or laundry, or of any place from which work is given out, or any contractor employed by any such person, causes or allows wearing apparel to be made, cleaned or repaired in any dwelling-house or building occupied therewith whilst any inmate of the dwelling-house is suffering from scarlet fever or smallpox, then, unless he proves that he was not aware of the existence of the illness and could not reasonably have been expected to become aware of it, he is liable to a fine not exceeding £10."

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VOL. XVI.—APPENDIX.

PAPERS READ BEFORE

THE SANITARY INSTITUTE,

THE SANITARY INSTITUTE OF GREAT BRITAIN,

AND

THE PARKES MUSEUM,

1876—1894.

BEING AN INDEX TO THE

TRANSACTIONS OF THE INSTITUTE,

VOLS. I. to XV.,

AND

MISCELLANEOUS PAPERS,

VOLS. I. to III.

SEPTEMBER, 1895.

[redacted]

THE SANITARY INSTITUTE.

PAPERS READ BEFORE THE INSTITUTE SINCE ITS FOUNDATION IN 1876 TO DEC., 1894,

Being an Index to the Transactions.

In order to make this list as far as possible a complete record of papers read, several titles are included of papers not published in the Transactions, and also of lectures delivered in the Parkes Museum; these are, however, preserved in the Volumes of Miscellaneous Papers, and can be referred to in the Library.

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